GENERATION, TRANSMISSION AND APPLICATION OF THE POWER SERVICES

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# Power

August
1951 · 50¢

A McGRAW-HILL PUBLICATION

combined with Operating ENGINEER

We'll make 12 million more kw in '52—p 103

# Ready to go!

The new Danskammer Point Steam Station on the Hudson River between Beacon and Poughkeepsie.

Air photo by George J. Parker, Newburgh, N. Y.

**Central Hudson Gas & Electric Corp.** will soon be able to furnish an additional 60,000 kw to the busy defense plants above New York City. Engineered by Burns & Roe, Inc., the new plant on the Hudson River at Danskammer Point will have an ultimate capacity of from 240,000 to 300,000 kw.

The present installation includes one 500,000-lb-per-hr steam generator with a design rating of 1840 psig. Initial and reheat temperatures are both 1000°F. At the turbine throttle, the steam pressure is 1650 psig. Ash from the boiler is removed hydraulically by Hydrojet; dust is handled automatically by a Hydrovac (pneumatic) System. Ashes and dust are collected in a transfer sump, and are then pumped to the diked area at the left of the plant. When filling is complete, this area will be used for coal storage.

Hydrojet and Hydrovac Systems like those at Danskammer Point are the product of cooperative pioneering by power plant designers and A-S-H engineers. The experience that we've gained in helping to develop these modern ash and dust disposal systems can be of vital assistance to you on your next project. Don't hesitate to call on us!

**THE ALLEN-SHERMAN-HOFF CO.**

**Dept. A—259 E. Lancaster Ave., Wynnewood, Pa.**

*Offices and Representatives in Principal Cities*

## HYDROJET (hydraulic) HYDROVAC (pneumatic)

## materials handling systems

# Emptying a few gondola cars a day... or a few thousand a week?

## LINK-BELT equipment does either job... better

**Get an unbiased recommendation for the right type of railroad car unloader for your needs**

Be sure you get the right railroad car unloader for your particular requirements. Only Link-Belt builds both types — the Rotary Dumper for large users ... the low-frequency Car Shaker for smaller operations.

You'll save time and manpower with either. For both are precision-engineered by Link-Belt to do a specific job faster ... more gently ... at lower cost to you.

**It's easier on cars** ... thanks to exclusive low-frequency vibration. And the Link-Belt Car Shaker also has a much lower noise level. Positive action gets most hopper bottom cars "broom-clean" in a few minutes. Especially good for damp, sticky materials. Write for Book 2345.

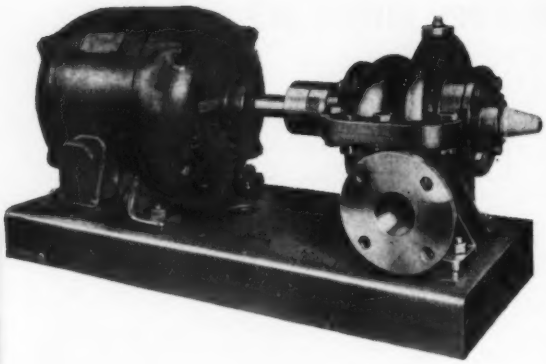
**Unloads gondolas in 90 seconds** or less (including return to upright position)! Simple, automatic, fool-proof — Link-Belt Rotary Car Dumper can be operated by unskilled labor. Takes all types of open top cars — any length, width or height ... up to 90-ton capacity. Book 1004 has complete data.

**LINK-BELT**

**CAR SHAKERS and ROTARY DUMPERS**

LINK-BELT COMPANY: Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa). Offices in Principal Cities. 12,351

# on the shelf



## Now you can get immediate delivery of new De Laval GS pumps

A pump "on order" won't help you a bit. Why wait for delivery of a standard centrifugal pump when we have these GS pumps, motors and bedplates in stock waiting to be assembled and shipped.

**SIZES:** 2½", 3" and 4"
**CAPACITIES:** To 280 gpm
**HEADS:** To 75 ft
**RPM:** 1750
**SHIPMENT:** *TWO WEEKS*

### DE LAVAL GS "EXTRAS"

- **MECHANICAL SEALS** . . . no stuffing box to pack or adjust
- **PRE-LUBRICATED BEARINGS** . . . no lubrication required
- **HORIZONTALLY SPLIT CASING** . . . cover can be lifted without breaking piping connections
- **EASY MAINTENANCE** . . . all parts interchangeable and available from stock
- **PROVEN ROTOR REPLACEMENT PLAN** . . . an added benefit designed especially to eliminate time-consuming maintenance involving individual fitting of spare parts . . . simply install complete rotor assembly in a matter of minutes. Complete interchangeable rotor assemblies are available immediately from factory stock.

### Also on the shelf...

**SIZES:** 2½", 3" and 4"
**CAPACITIES:** To 400 gpm
**HEADS:** To 230 ft
**RPM:** 3500
**SHIPMENT:** Bare Pump–Immediately
*completely assembled pumps, 1 week after receipt of the motor.*

### GET MORE FACTS . . . FAST!

DE LAVAL STEAM TURBINE CO., TRENTON 2, NEW JERSEY

☐ I'm in a hurry. Please have an engineer call me.
☐ I'm interested. Please send me literature.

*Name* _____

*Company* _____

*Street* _____

*City* _____ *State* _____

DL 103

**DE LAVAL STEAM TURBINE COMPANY**
TRENTON 2, NEW JERSEY

50th DE LAVAL Anniversary

# Power

AUGUST 1951 VOLUME 95 NO. 8

combined with Operating ENGINEER

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August 1951 **POWER** Vol 95—No. 8

(Member ABC and ABP)

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**NEW KW FOR '52** shipment will come close to 12 million, as compared with this year's 8.7 million, a breathtaking record in itself. This truly tremendous expansion in production of generating equipment results from: (1) extended work weeks in many parts of the shops and multiple-shift operation for important machine tools (2) considerably higher average size of units, and (3) savings in engineering and shop time from relatively high percentage of duplicate and preferred-standard units.

Taken in the East Pittsburgh shops of Westinghouse Electric Corp, our cover photo symbolizes the manufacturing phase of the battle to give us the power to rearm. On the inner frame of a giant generator, a skilled mechanic locates drilling points; unit frames the "skin" of another similar machine.

### *Next month . . .*

- At the famous 59th St Station of New York's subway system, giant angle-compound corliss engines rub shoulders with the last word in high-pressure high-temperature turbine-generators. For a 50-year panorama of power progress, at one site, see our Sept story.
- Diesels proved the answer to one utility company's need for rapid expansion of capacity. Read how they standardized plant designs and equipment for savings in time, dollars.
- Burning wet bark is always tough and particularly so when logs float to the mill by sea. Celanese Corp engineers come up with a new answer. They've adapted the sugar-cane mill for fuel preparation, like the results.
- Going to buy some gearmotors? You'll find helpful tips on available types, pointers on selecting them.

### *. . . and future months*

- Been hearing a lot about power at Niagara Falls? You'll want to read our roundup on this great power producer, what's under way, what's ahead.
- Keep an eye peeled for detailed dope on the way one power station controls its new cyclone furnaces.

# UP THE POWER . . . REDUCE THE COST

## . . . by using the Texaco Steam Cylinder Oil that's right for YOUR conditions

Old or new, your steam engine will deliver more power and work more hours under heavier loads when lubricated with the Texaco steam cylinder oil designed for your particular operating conditions. Your Texaco Lubrication Engineer will gladly help you select the proper one.

*All* recommended Texaco steam cylinder oils atomize completely, coating cylinder walls and pistons with a tough, properly adhesive film that resists heat and wash-off. Rings stay steam-tight . . . valves function smoothly . . . wear and maintenance cost go down.

If steam is used for processing, you can get a Texaco steam cylinder oil that separates rapidly and completely from the exhaust.

Texaco is your best bet for greater steam engine efficiency and economy. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

**TEXACO Steam Cylinder Oils**

**FOR EVERY OPERATING CONDITION**

# Power

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## ...with Power readers...

STRIKE TWO!

*I find the* POWER *Handbook, Part 2, full of useful information. However, I wish to make a correction to "Corrections—Part 1" (p 105). Shouldn't 539 ft be 539 lb?*

*Please advise whether or not Parts 1 and 2 of the Handbook will be available in reprint form.*

*Easton, Pa.* JOHN J BACICA

To Reader Bacica an orchid, to POWER editors a lemon! Of course you're right, Mr Bacica, and we're wrong—not once but twice, which probably sets some kind of a record. We wish we had a long and involved explanation but the fact is we looked at that "ft" at least five times, without ever once noticing that it wasn't "lb".

As to reprints—yes, they are available, at $1.00 per single copy combining Parts 1 and 2.—*Ed.*

READER VISITS

Last week, an old friend and contributor dropped in at the big green building on 42nd St. It was S C Page of Buffalo, N. Y., whose name will be familiar to many readers of POWER. Now retired, he was spending his leisure seeing New York with Mrs Page. Lunching with some of our staffers, he told us he has been reading POWER for close to 50 years. Which led us

(*Continued on page* 212)

## ...lines and bylines

John I Yellott

**TOUGHEST JOB** to come down the pike in years — making a gas turbine burn coal — fell to John Yellott when he became director of research for BCR's Locomotive Development Committee in 1945. How to keep flyash from chewing blades? How to feed coal, pulverize it and burn it under pressure at new high rates? And, how to wrap it all up in a locomotive's snug confines?

Tackling exacting problems like these has been John's forte almost from the day he left Johns Hopkins (MME) in 1933. After a year teaching at University of Rochester, he became instructor and asst prof at Stevens. Here he got his hand in with research on high-vacuum ejectors and reducing-valve noise. More extra-hours work marked three years as director of Illinois Inst of Technology's ME dept.

Full-time research claimed him in 1943 when he moved over to the Institute of Gas Technology as director. How's he doing with the coal-burning gas turbine? Turn to p 90 for the latest report.

John B Murphy

**START AT THE BOTTOM** isn't just a slogan to John Murphy. He broke into the waterworks field at the end of a shovel in a Pomona, Calif. ditch. Before he finished his stint with the water dept, he had been shift operator and maintenance mechanic.

He moved to New York in 1939 and, after a short spell as a "yard bull" for the Pennsy, started with his present employers — American Waterworks Service Co. From '41 to '46 he traveled the U.S. as service engineer, conducting major overhauls, trouble-shooting. Promotion to the engineering dept as senior service engineer acknowledged a sure touch with balky wells and well pumps.

Hobbies, he says, are contributing to McGraw-Hill magazines (see p 74 for evidence), hunting, fishing, amateur gunsmithing, making almost anything from furniture to model steam engines.

Wayne J Farrell

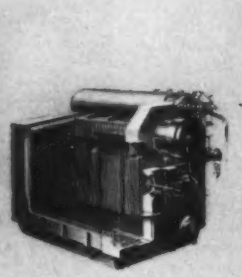
**MAN OF ACTION** Wayne Farrell (p 107) earned his title the hard way. Back in 1928 he started at Eastman Kodak's Hawk-Eye plant as a glass molder. Today, he's chief operating engineer in charge of power for that plant.

Natural mechanical aptitude and love for machinery cost Kodak a good molder when Wayne followed his bent into the power field. Night classes at Mechanics Inst and Rochester Inst of Technology prepared him for advancement in it.

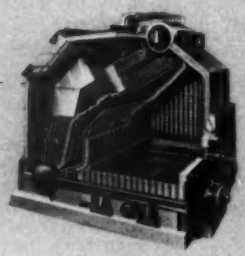
The practical know-how came from a variety of jobs — as oiler, in steamfitter and electrical gangs. Starting as fireman in the Hawk-Eye power plant in 1935, he quickly moved up to asst operating engineer. When Hawk-Eye's new power plant went on the line in 1941, Farrell was chief. Active in NAPE, he's past chairman of the Rochester chapter, held many committee posts. He believes in passing along his know-how; for seven years he has taught steam engineering at Rochester Inst of Technology.

# —now ...B&W INTEGRAL-FURNACE

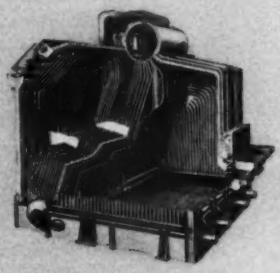
## for steam requirements from 2800 to 350,000 lb. per hr.



TYPE FM
(Factory-assembled Unit)



TYPE FF



TYPE FJ

### cost-saving features

- Minimum floor space and headroom requirements
- High fuel economy
- Smokeless combustion
- Adaptable to all fuels and firing methods
- Economical fast steaming
- Water-cooled furnace
- Clean, dry steam at all ratings even with high boiler water concentrations
- Quick response to wide and heavy load swing demands
- Easy to inspect and clean
- High availability with least attention

### over 167 million lb. of steam per hr. for these industrial, utility, and other users

Abrasives
Airlines
Automotive
Baking
Beverages
Brewing
Building Materials
Candy
Chemicals
Dairy
Distilling
Drugs
Electrical
Electronics
Food
Foundry
Fruit Packing
Glass
Iron & Steel
Laundry
Leather
Lumber
Machinery
Meat Packing
Metal Working
Mining
Non-Ferrous Metals
Oil Refining
Paint
Paper
Plastics
Process
Rubber
Sugar
Textile
Tobacco

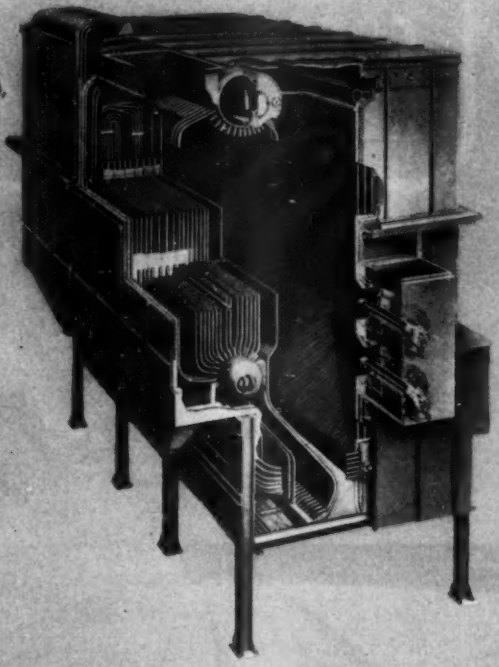
***Utilities***
Gas Companies
Municipal Plants
Power Plants
Railroads

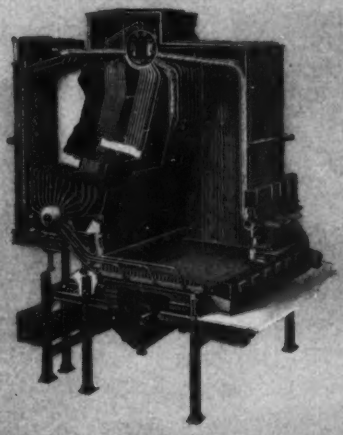
***Others***
Colleges
Florists
Hospitals
Hotels
Housing Projects
Institutions
Military Posts
Navy Yards
Office Buildings
Ordnance Plants
Stores

## BOILER ADVANTAGES

*Examples of B&W Engineering For Economy*

TYPE FH
with hopper bottom (as shown), or flat floor





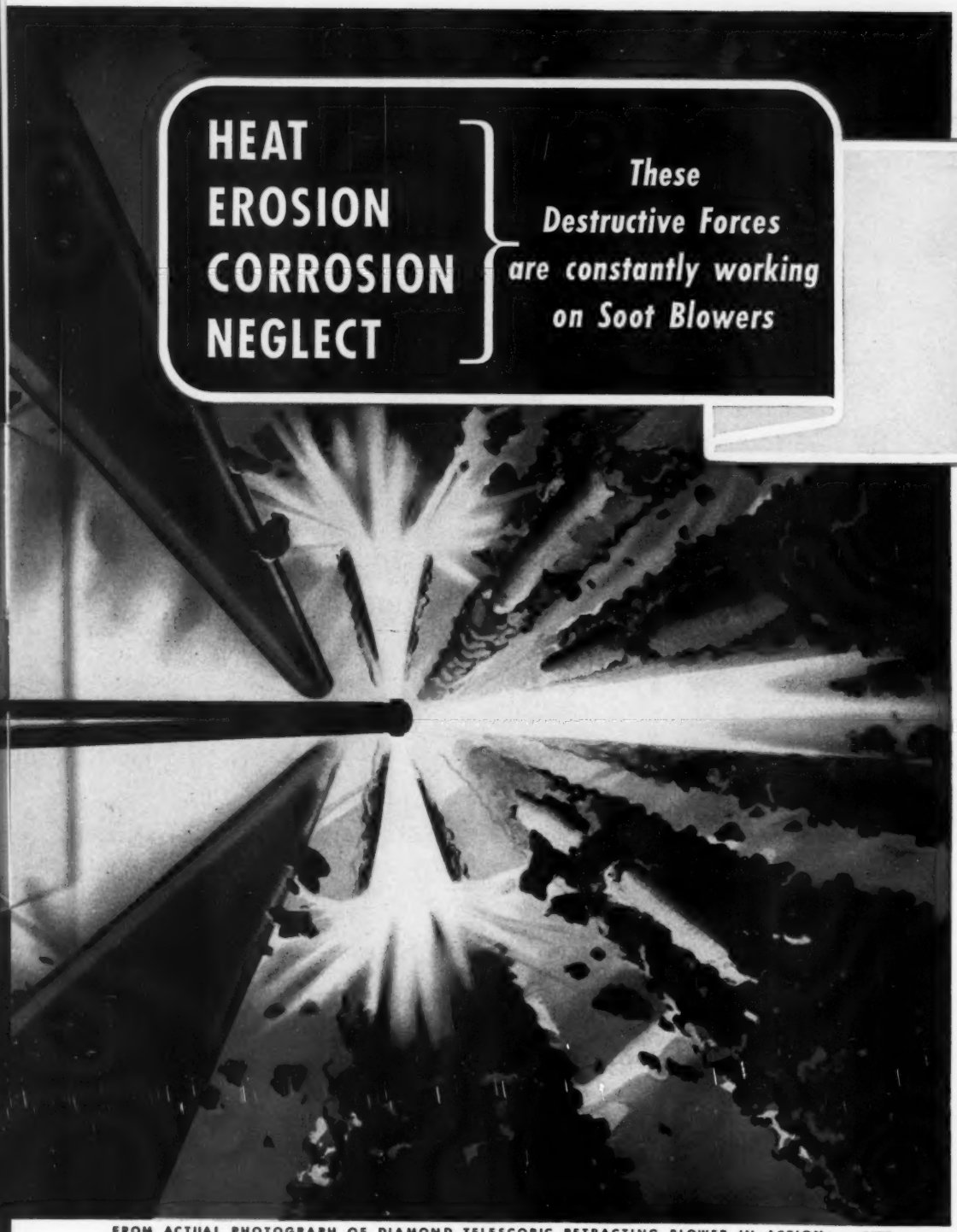
TYPE FL

# the B&W integral-furnace BOILER family

| TYPE | CAPACITY RANGE LB. STEAM/HR. | PRESSURE PSI | TEMPERATURE | FIRING |
|---|---|---|---|---|
| FM | 2,800- 25,000 | 15- 275 | Saturated | Oil and Gas |
| FF | 8,000- 50,000 | 160- 600 | Superheat | Stoker, Oil, and Gas |
| FJ | 30,000- 70,000 | 160- 800 | Superheat | Stoker, Oil, and Gas |
| FL | 60,000-120,000 | 160-1050 | Superheat | Stoker, Oil, and Gas |
| FH | 50,000-350,000 | 160-1050 | To 910 F | Pulverized, Coal, Oil, and Gas |

BABCOCK & WILCOX

G-5227




FROM ACTUAL PHOTOGRAPH OF DIAMOND TELESCOPIC RETRACTING BLOWER IN ACTION

This ad first appeared in the April 1940 issue of "Power". Its message is even more important today!

# That's why you need the BEST SOOT BLOWERS MONEY CAN BUY!

No other equipment in the power plant has so much demanded of it as have the soot blowers. Soot blowers receive less attention than anything else—must meet conditions of heart-breaking severity—rarely get even so much as a drop of oil. Heat, erosion, corrosion, neglect—all these destructive forces are at them continually.

Yet, soot blowers are expected to do their work—instantly—efficiently—any time—month after month and year after year.

Their installed cost is only a minor portion of the cost of any power plant, so—

Why try to save on the capital cost of anything of which you expect so much? Certainly the very best you can get is none too good for such an assignment. The great majority of power engineers have found that the extra values of Diamond Soot Blowers are worth far more than their slight additional cost.

Lancaster, Ohio

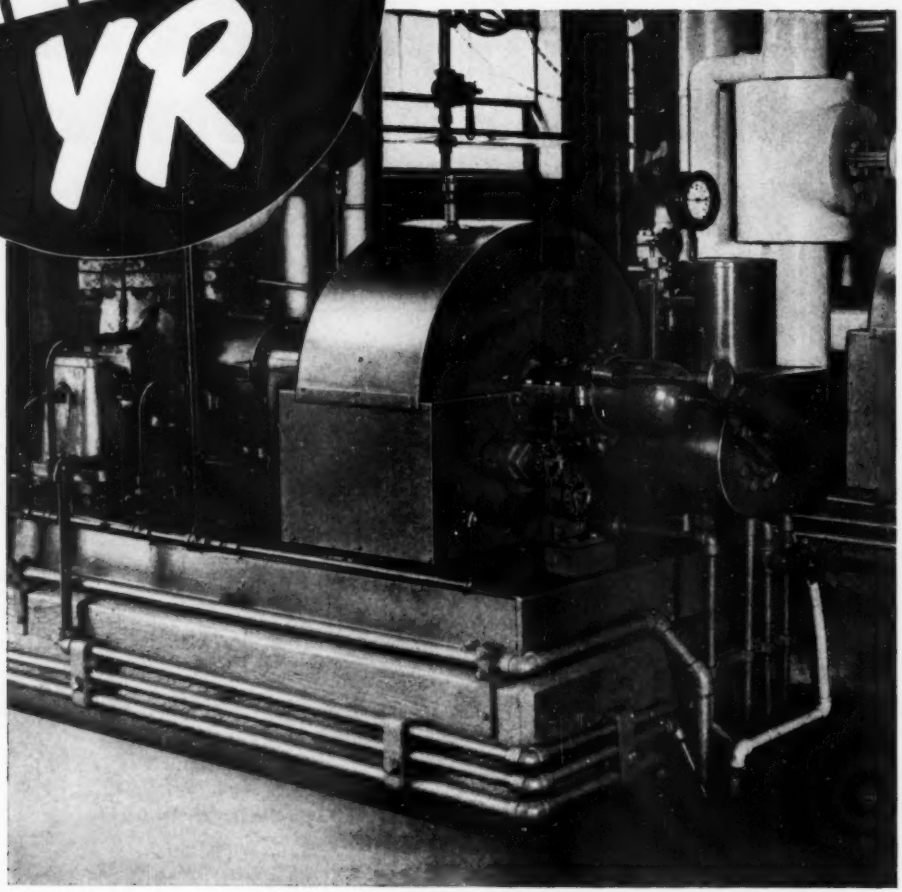
**DIAMOND POWER SPECIALTY CORP., ~~Detroit, Michigan~~**
**DIAMOND SPECIALTY, LIMITED, Windsor, Ontario**

***Diamond Soot Blowers are Used in More Than 80% of All Modern Power Boilers***

As true today as it was in 1940

4512

# ELLIOTT YR *the Turbine*

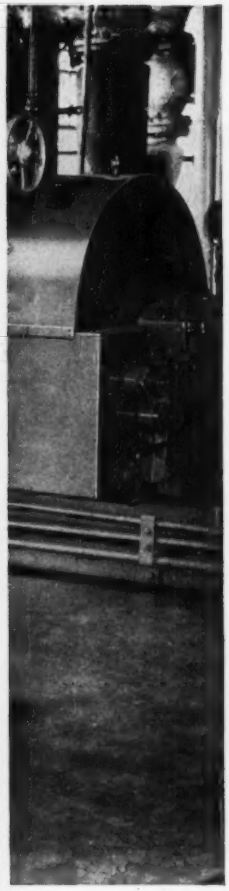


**Elliott YR turbines may be furnished, when so specified, with carefully tailored, neat appearing, and readily removable jacketing, as in this installation.**

**ELLIOTT COMPANY**

STEAM TURBINE DEPT.
JEANNETTE, PA.
Plants at: JEANNETTE, PA. • RIDGWAY, PA.
AMPERE, N. J. • SPRINGFIELD, O. • NEWARK, N. J.
DISTRICT OFFICES IN PRINCIPAL CITIES

# *that has everything!*



**1 ADAPTABILITY**— Every plant engineer wants turbines tailored to his needs—if he can get them. In the YR, he can—and without sacrifice of standardization. Permissible modifications cover the widest possible range. Actually, eight types of turbines are available on five basic frames . . . one basic design of governor valve, six elective types of governor . . . several types of speed changer, emergency tripping mechanisms . . . gland seal arrangement for condensing operation and for operation with gas . . . with these and a number of other modifications practically any requirements can be met.

**2 RELIABILITY**— Here is a quality for which Elliott turbines have long been renowned. In the YR, this quality has been further enhanced by improving manufacturing facilities and details of design upon which reliable operation depends.

**3 ECONOMY**— Added to the operating saving in using a turbine practically built for its specific conditions, is the further direct saving in the reduction in stocking replacement parts due to the interchangeability of wearing parts on all frame sizes. One of the benefits of standardization.

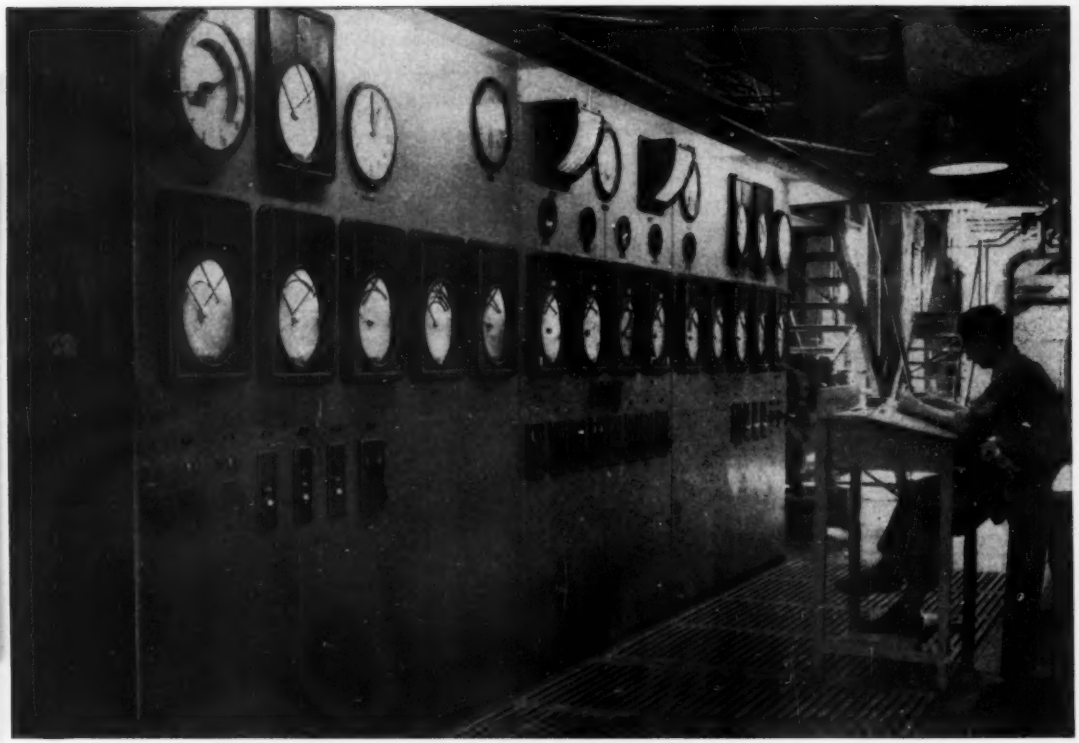
**4 REPUTATION**— The high standing which Elliott turbines have earned everywhere is the best safeguard an engineer can have to sustain his selection of YR turbines. As one engineer said to another who had been having drive troubles, "Why don't you put in Elliott turbines and stop worrying?" In this he voiced an opinion almost universally held.

*Whatever you want in a mechanical drive turbine you can get in a YR. Bulletin H-16 has all the details—write for it.*

H-729

STEAM TURBINES • GAS TURBINES • GENERATORS • MOTORS • CONDENSERS
FEEDWATER HEATERS AND DEAERATORS • STEAM JET EJECTORS
CENTRIFUGAL BLOWERS • TURBOCHARGERS FOR DIESEL ENGINES
TUBE CLEANERS • STRAINERS • EXPANDERS • FILTERS

# What's YOUR Fuel-dollar



*This Bailey Boiler Control Panel insures high efficiency in the use of Fuel-Dollars at a Western Chemical Plant. It includes Bailey Combustion Control, Bailey Three-Element Feed Water Control and Bailey Steam Pressure Reducing Control for two oil-fired boilers.*

*Controls for Steam Plants*

COMBUSTION • PRESSURE
FEED WATER • LIQUID LEVEL
TEMPERATURE • FEED PUMPS

# Efficiency ?

A dollar's worth of fuel has the *same potential* energy, no matter who's boiler it fires. But how much of the energy actually gets converted to a usable form depends on how you operate your boiler.

That's where Bailey Controls can help. And, here's why, we believe, you'll get better fuel-dollar efficiency with Bailey:

1. **Complete Range of Equipment—fully co-ordinated.** You need never worry that a Bailey Engineer's recommendation is slanted in favor of a particular type of equipment, just because he has a limited line to sell—or that Bailey will pass the buck for efficient control; we offer *complete* boiler control systems.

2. **Engineering Service—backed by experience.** No other manufacturer of instruments and controls can offer as broad an experience, based on successful installations involving all types of combustion, flow measurement and automatic control.

3. **Direct Sales-Service—conveniently located near you.** Bailey Meter Company's sales-service engineers are located in more industrial centers than those of any other manufacturer of boiler control systems; you get prompt, experienced service with a minimum of travel time and expense.

For better fuel-dollar efficiency—for more power per fuel-dollar, less outage and safer working conditions, you owe it to yourself to investigate Bailey Controls. Ask a Bailey Engineer to arrange a visit to a nearby Bailey installation. We're proud to stand on our record: "More power to you!"

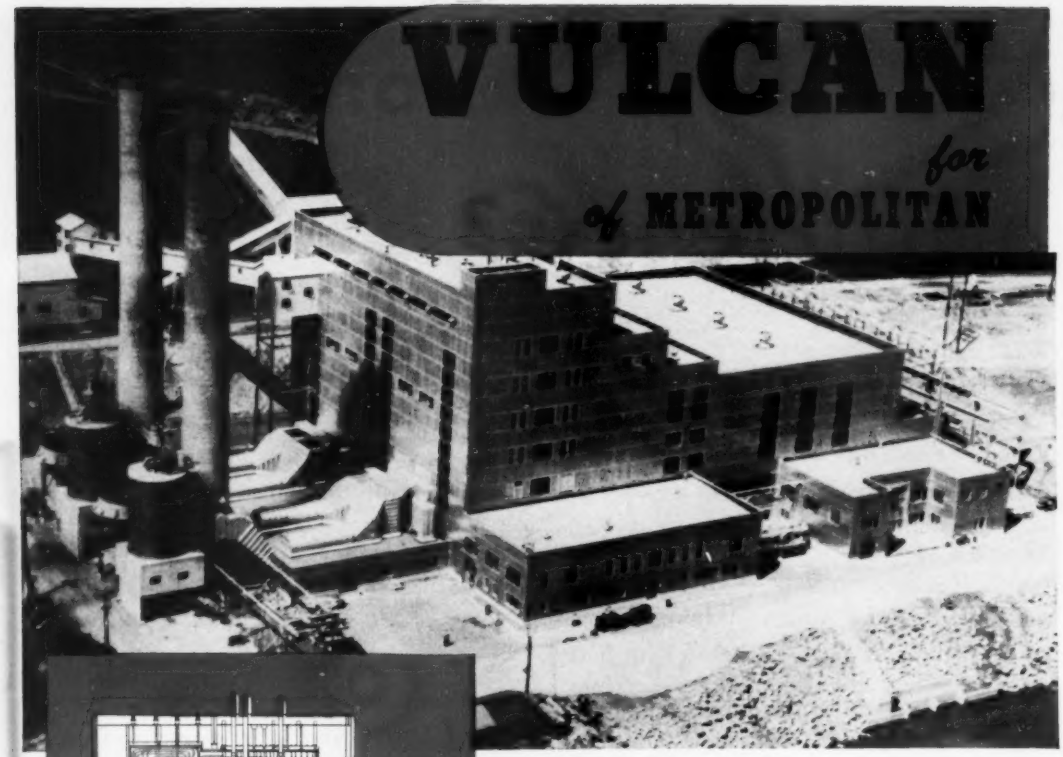
A-109

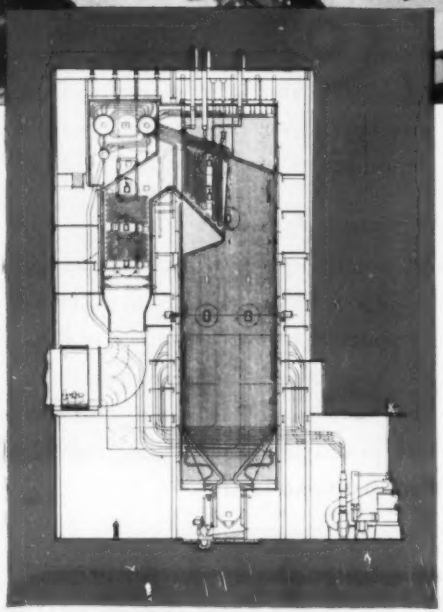
**BAILEY METER COMPANY**

1036 IVANHOE ROAD • CLEVELAND 10, OHIO

BAILEY METER COMPANY, LIMITED • MONTREAL, CANADA

# VULCAN *for* of METROPOLITAN





The first two units are now in service at Titus Station of Metropolitan Edison Company, near Reading, Pennsylvania.

Each of the two reheat boilers was built by Combustion Engineering-Superheater, Inc., with a capacity of 510,000 pounds of steam per hour at 1450 psi and with reheat to 1010 degrees F. Firing is with pulverized coal.

Boiler cleaning is by Vulcan, with fully automatic-sequential control. Each boiler has ten long retractable soot blowers driven by electric motor, eight air-driven wall blowers, and controls for the two electric-driven air heater blowers. Air is the blowing medium.

The consulting engineers for Metropolitan Edison Company were Gilbert Associates, Inc.

# VULCAN *Automatic*

# AUTOMATIC—SEQUENTIAL SYSTEM

## TITUS STATION
## EDISON COMPANY

Metropolitan Edison Company a Vulcan user at Crawford and Eyler Stations, has now swung to *fully automatic-sequential* Vulcan soot blowing for Titus Station.

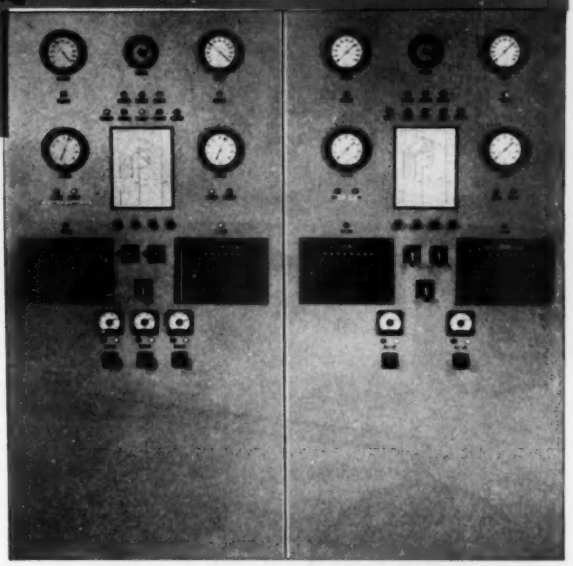
Standing at the control panels, adjacent to all other boiler instruments, the operator now does the complete soot-blowing job by merely pushing a single button.

Operation of the Vulcan system is right before his eyes. He can see at a glance that each unit automatically cuts into operation at the right time and pressure, blows for the proper period, and cuts out of service. If any unit requires more—or less—frequent blowing, the control is at his fingertips.

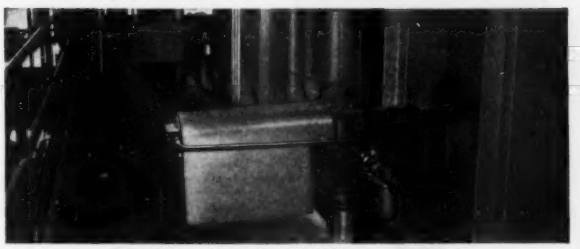
There is no need to waste time or effort climbing to remote locations —no excuse for forgetting to blow on schedule.

A Vulcan Automatic-Sequential System is designed to clean boilers better at lower cost. Bulletin 483 tells the story. Write for it.

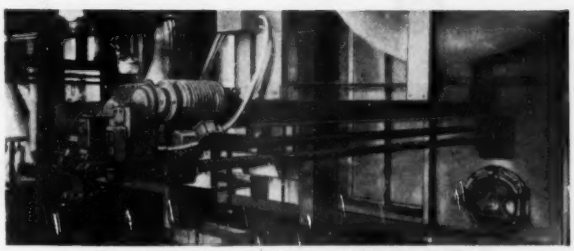
**VULCAN SOOT BLOWER DIVISION**
Continental Foundry & Machine Company
**DU BOIS, PENNSYLVANIA**



Control panels, Vulcan Automatic-Sequential Systems

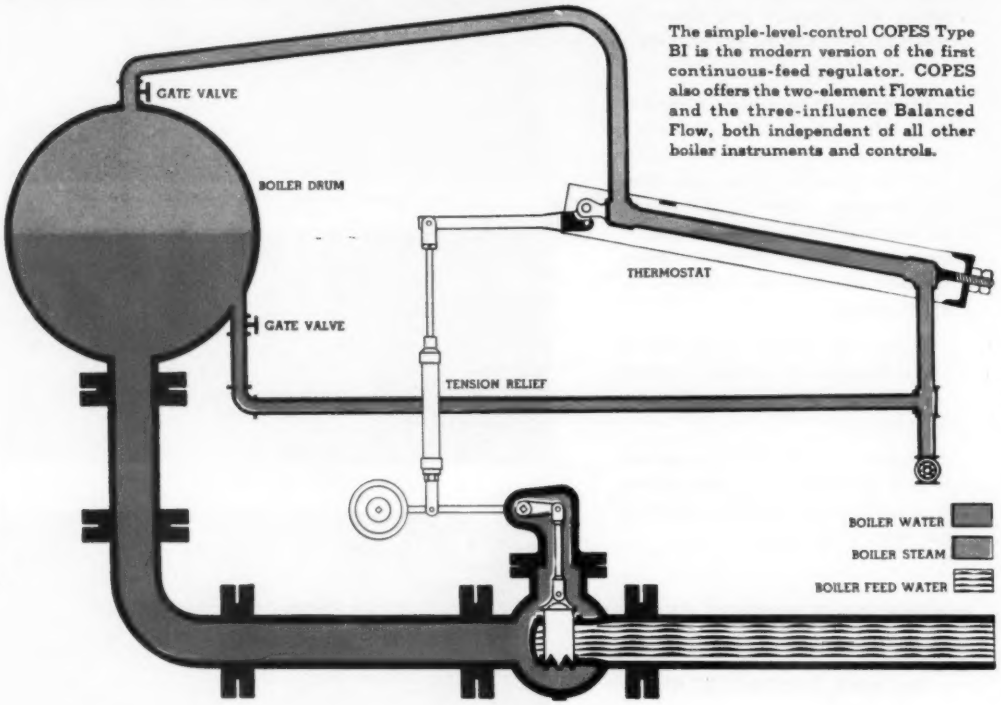


Two of the eight Vulcan Wall Blowers on Unit 1



One of ten Vulcan Long Retractable Blowers, Unit 1

# COPES
## with Continuous Boiler




The simple-level-control COPES Type BI is the modern version of the first continuous-feed regulator. COPES also offers the two-element Flowmatic and the three-influence Balanced Flow, both independent of all other boiler instruments and controls.

COPES

## BOILER FEED

# was FIRST
## Feed Water Regulation

MANY laughed when, back in 1913, COPES engineers first suggested feeding a boiler continuously. But a few central station engineers took a chance and permitted trial installations. Thanks to their help, the then-new principle was proved correct. Now all modern feed water regulators feed continuously.

Since then, other engineers in important plants have helped COPES score many more "firsts" in feed water control. Even today experimental installations are pointing the way to new concepts of efficiency, economy and safety in boiler feeding. COPES is, and will continue to be, prepared for your most difficult jobs.

**NORTHERN EQUIPMENT DIVISION**

**Continental Foundry & Machine Company**

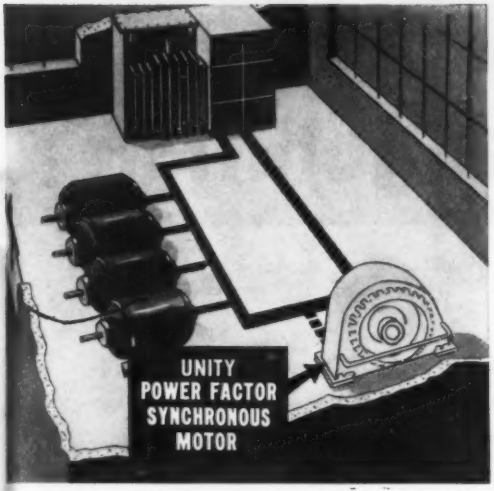
**811 GROVE DRIVE, ERIE, PENNSYLVANIA**

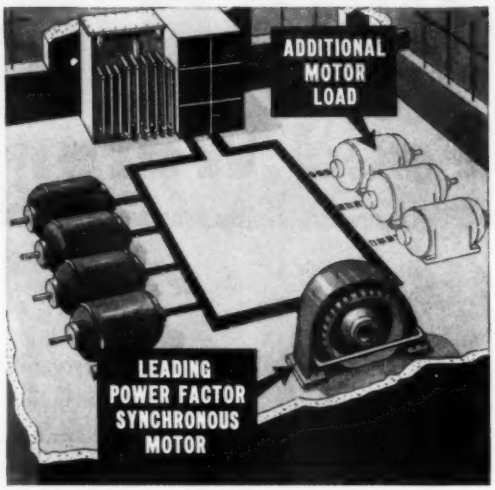
***Headquarters for* Feed Water Regulators, Pump Governors, Differential Valves, Level Controls, Hi-Low Alarms, Reducing Valves, Desuperheaters**

# WATER REGULATION

# How to get more out

## . . . . *install G-E Synchronous Motors*




If your plant power system is loaded close to full capacity and you have a place where a large constant-speed motor can be used, you may be able to install a *unity power-factor* synchronous motor without increasing the kva load on your system.

Or, if your power system is already overloaded, then a *leading power-factor* synchronous motor can actually supply kvars to your system while performing its usual drive duties. Then you can often install additional inductive apparatus to an existing system without fear of overloading feeder lines.

If you are planning plant expansion or you need more motors and /or suspect power system overloading, contact the nearest G-E sales engineer. He'll help you survey your system, and help you determine the type of synchronous motor you need—should this be one answer to your power system problems. *General Electric Company, Schenectady, N.Y.*

### NEW! A Helpful Training Course on Motors!

**Everyone concerned with technical training problems will want this new G-E Motor Selection and Application Course. Consists of 9 short, easily understood lessons. Complete kit—slide films, review booklets and instructor's manual—$100. Call or write your nearest G-E sales office, or send for free copy of 96-page instructor's manual.**

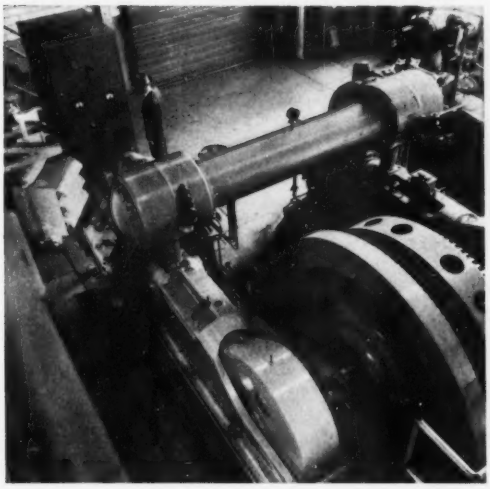
Look at the scope of this Course

1. Fundamentals of Motors
2. Types of Motors
3. Fundamentals of Selection
4. A-c Induction Motors
5. Single-phase Motors
6. D-c Motors
7. Synchronous Motors
8. Adjustable-speed Drives
9. Gear Motors

GENERAL ELECTRIC

# of your power system

## *for unity and leading power-factor drives*

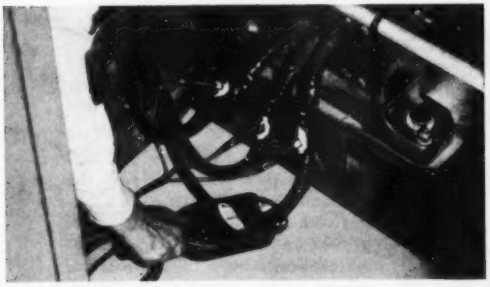


***Control, too, will protect your system***—G-E Limitamp high-voltage control provides ample interrupting capacity, protection for operating personnel, good appearance, and compactness. Here it controls and protects a 35′ 1p G-E synchronous motor.

**G-E SYNCHRONOUS MOTORS ARE DRIVING . . . .**

| | |
|---|---|
| *pumps* | *saws* |
| *compressors* | *generators* |
| *Jordans* | *rolling mills* |
| *beaters* | *pulp refiners* |
| *crushers* | *chippers* |
| *ball mills* | *flour mills* |
| *tube mills* | *stock refiners* |
| *large conveyors* | *line shafts* |
| *blowers* | *fans . . . .* |

*in all types of industries where their efficiency, low first cost, and reliability make them exceedingly popular.*



***Check power factor on individual circuits***—easily, quickly—with new G-E hook-on power-factor meter. This portable instrument hooks around the line—no cutting of conductors, no costly shutdowns to make power checks. You can accurately locate those circuits where corrective action is needed.

General Electric Co. Sect. D770-25
Schenectady 5, N. Y.

Please send me the following literature. .

☐ for reference purposes
☐ for planning an immediate project

( ) GER-234—Synchronous Motors Do Two Jobs at One Time
( ) GEA-5332—Low-speed Synchronous Motors
( ) GEA-5426—High-speed Synchronous Motors
( ) GEA-5469—G-E Testing Instruments
( ) GEZ-310—Motor Training Course Instructor's Manual

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Company .....

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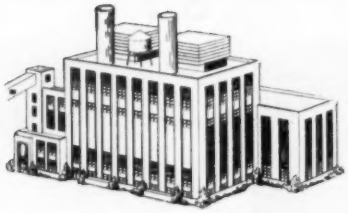
*mail this coupon today*

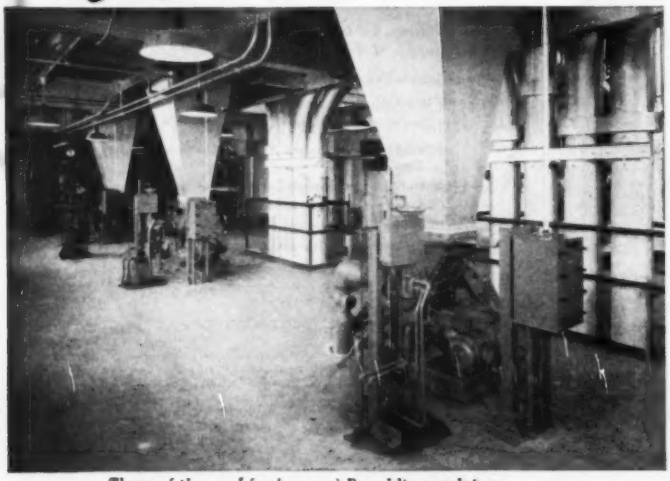


● at the New GADSDEN

Steam Plant of the

Alabama Power Company

# *Efficiency* HAS BEEN



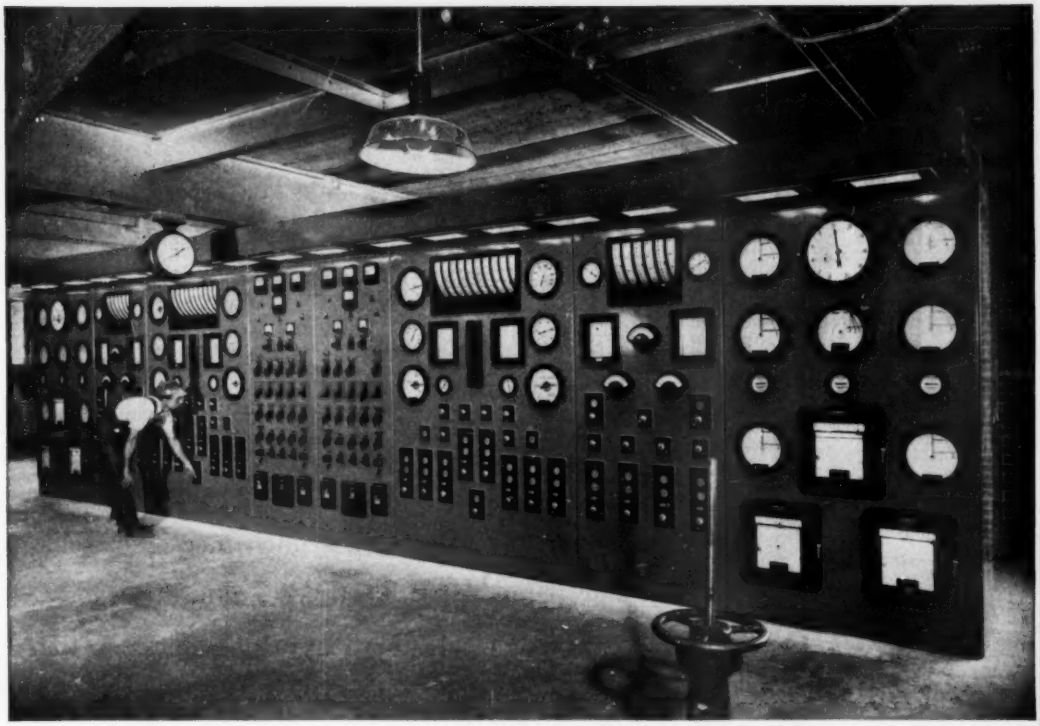
*Three of the coal feeders and Republic regulators serving one of the boiler units.*

It is the policy of Alabama Power Company to generate, transmit and distribute electricity to its customers at the lowest cost consistent with good service.

When designing the new 120,000 kw. Gadsden Steam Plant, the Alabama Power Company, in keeping with this policy, incorporated proven engineering developments which contribute to economical power generation. High among these was REPUBLIC automatic boiler control.

Two steam generators, each with a capacity of 600,000 pounds of steam per hour, and operated at 875 psig. and 885°F, supply steam to the two turbines. Fuels used are natural gas or pulverized coal, either singly, or in combinations.

The REPUBLIC control board is



*On this Republic control board are mounted all gauges, meters and controls for operating each of the two boilers and their auxiliaries.*

# MADE *Automatic*

made up of one electrical panel, one recorder panel, and two combustion control panels per boiler. All panels are joined together to form one continuous board for the two boilers. The boilers are rubber mounted to reduce vibration, are gray in color, and lighted from an overhead canopy.

The REPUBLIC combustion control system receives its initial impulse from the main steam line through the master controller which establishes a pneumatic loading pressure proportional to the boiler load. The loading pressure is transmitted to the variable speed coal feeders, and to the gas flow valve when burning gas in combination with coal. This pressure is also transmitted to the air flow regulator. A corrector regulator provides means for maintaining the proper steam flow air flow relationship. Provision has also been made for manually adjusting this ratio from the boiler panel.

Air flow and furnace pressure are regulated by hydraulic coupling speed, but fan damper controls are provided for use at extremely low loads, when the fan speed would be reduced below 30% of the motor drive speed.

The boiler feedwater pumps are equipped with REPUBLIC automatic minimum flow hand reset valves. These valves open when the flow through the pumps is 150 gpm or less and by-pass this amount of water to the deaerating heater.

The REPUBLIC feedwater regulator is located on the operating floor and can be manually operated during emergencies from the boiler control panel. The valve control is pneumatic, single element, but the valve is operated by a hydraulic cylinder.

For complete information on REPUBLIC automatic boiler control write for Data Book No. S-21.

**REPUBLIC FLOW METERS CO.** ● 2240 DIVERSEY PARKWAY • CHICAGO 47, ILLINOIS

# KVS

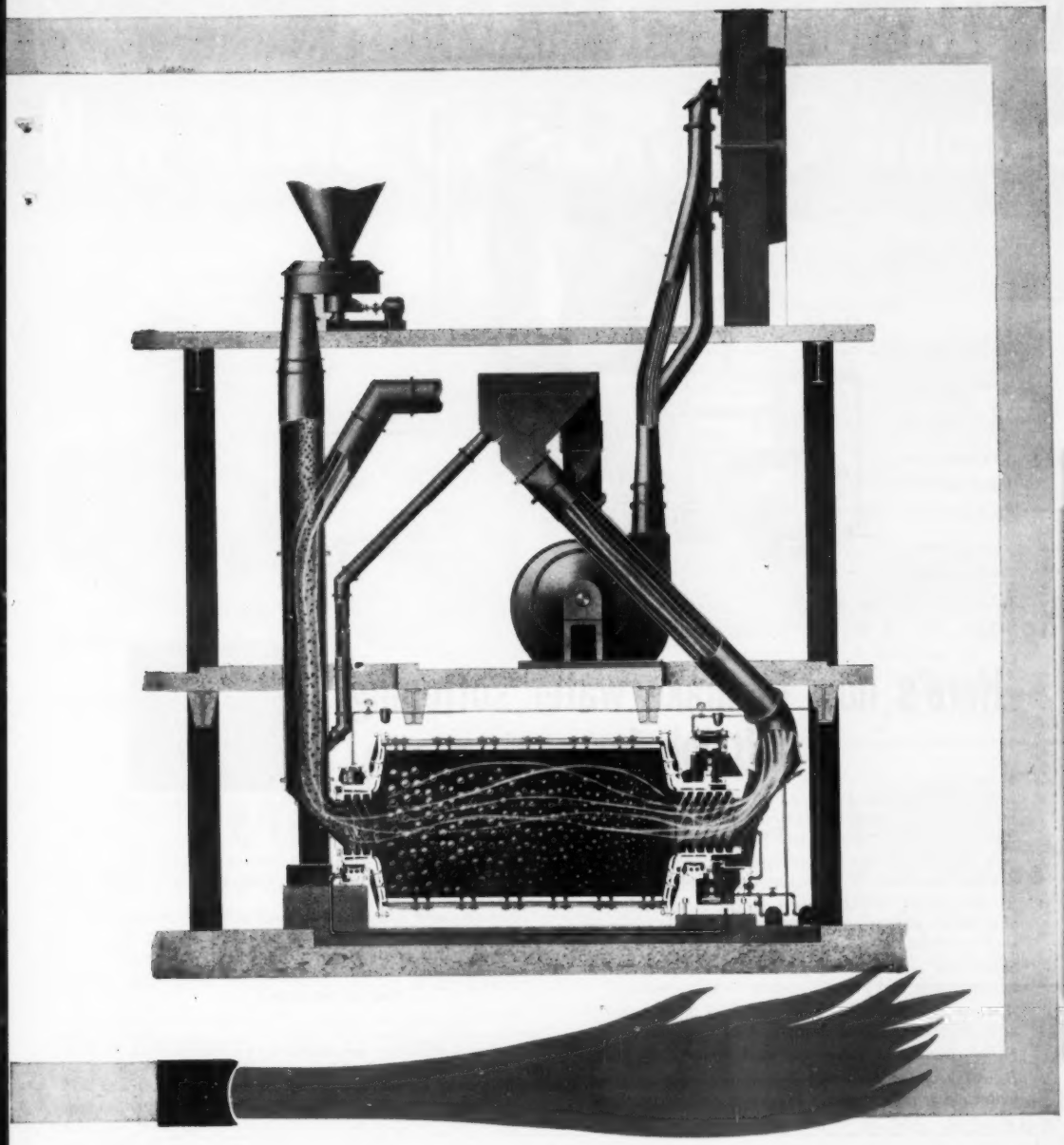
## AIR SWEPT TUBE MILLS *for* BITUMINOUS... ANTHRACITE...COKE BREEZE

The KVS Air Swept Tube Mill, a slow speed ball mill, prepares all grades of coal for combustion at low power and maintenance costs. The pulverizing balls are carried by centrifugal force to a point where they are thrown down on the coal in a continuous cascade of balls delivering thousands of blows per second.

The KVS variable speed fan draws air through the mill, floating out an impalpable powder to deliver a carbureted fuel to the burners.

**KVS offers a complete service in design, building and erecting complete steam generating plants under one responsibility. KVS engineers are available for consultation.**

**Ask for a copy of Engineering Bulletin No. 44-B containing valuable information on preparation of pulverized fuel and steam generation.**

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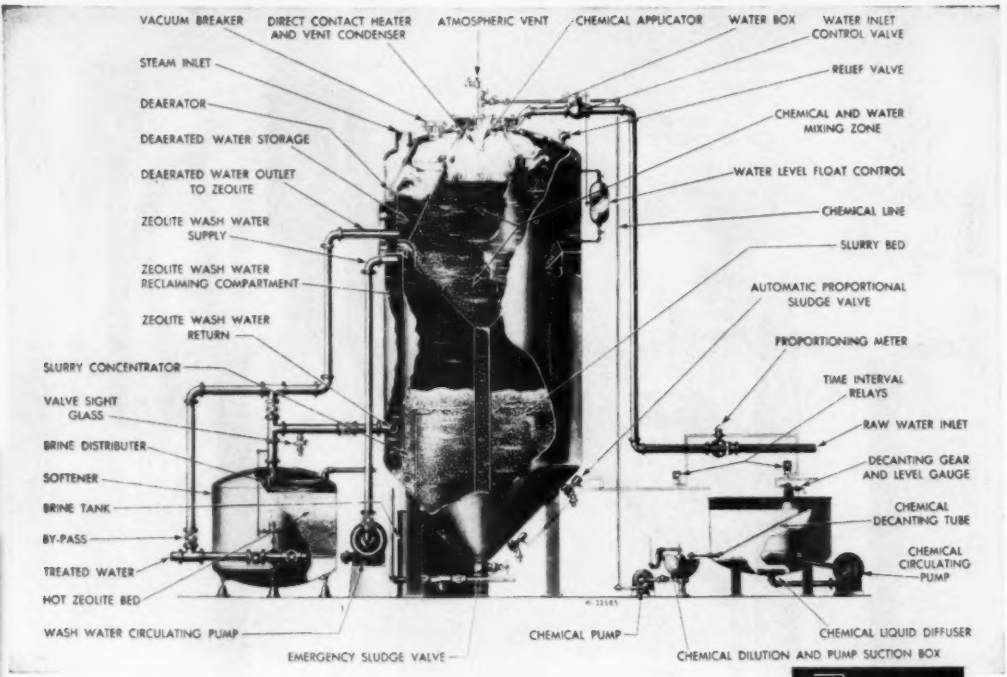
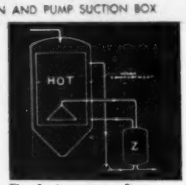



# Here's how to make water softening a soft job for you




You have less to do . . . to worry about . . . to pay for—when you use Worthington's revolutionary Hot-Z Slurry-Type Deaerating Water Softener.

It combines all the best features of Hot Process and Zeolite, plus these Worthington-originated features:

*No more scaling trouble.* Direct-contact vent condenser eliminates scaling trouble experienced with old-fashioned shell-and-tube types.

*Supervision reduced.* Concentrated sludge is removed automatically and proportionately to water volume.

*Assures uniformity.* Hydraulic chemical mixer assures uniformity of chemical strength. Also saves space.

*Easier cleaning* of valve-type wash water sight glass.

*Better deaeration.* Steam-jet deaeration is simpler, gives better efficiency—removes oxygen to .005 cc per litre.

*Independent backwash system.* Built-in annular wash water compartment provides clear hot water for backwashing and reclaims it without affecting operating velocities in treating zone. This feature not only pays off in systems employing filters, but also is ideal for backwashing the hot zeolite.

You also save because Worthington Hot-Z Systems operate on low-priced lime and salt. The average installation saves enough in chemical costs to pay for itself in 3 years!

**Get all the facts!**

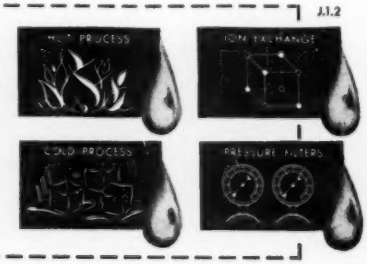
It will pay you to investigate the Worthington Hot-Z System thoroughly. Tell us your conditions of service and get our recommendation in terms of dollars and benefits. You'll find *there's more worth in Worthington.* Worthington Pump and Machinery Corporation, Water Treating Section, Dunnellen, N. J.

J.1.2

**WORTHINGTON**

**WATER CONDITIONING**

**Worthington Makes More of the Equipment for All Types of Water Conditioning Systems**



# NOW... Front-End Shovels for ALL 4 New ALLIS-CHALMERS Tractors

**14 Interchangeable Attachments**

Standard Buckets
Light Materials Buckets
Heavy-Duty Buckets
Rock Forks
Bulldozer Blades
Plus other attachments for some models

**Standard Buckets up to 4 cu. yd.**
**(light materials buckets up to 7 cu. yd.)**

**1-Yd. HD-5G**
Drawbar hp.: 40.26
Dumping Height*: 9 ft. ¼ in.
Total Weight: 16,200 lb.

**2-Yd. HD-9G**
Drawbar hp.: 70
Dumping Height*: 11 ft. 4½ in.
Total Weight: 29,800 lb.

**3-Yd. HD-15G**
Drawbar hp.: 102
Dumping Height*: 12 ft. 8 in.
Total Weight: 40,000 lb.

**4-Yd. HD-20G**
Hydraulic Torque Converter Drive—175 net engine hp.
Dumping Height*: 13 ft. 5 in.
Total Weight: 61,600 lb.

*Height of bucket hinge*

## Introducing a New Era of Tractor Usefulness . . .

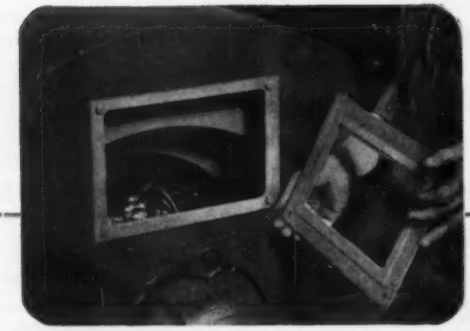
These new Tractomotive shovels on the larger size Allis-Chalmers tractors now bring you the same wide utility, the same outstanding performing ability as the popular HD-5G—the Tracto-Shovel that revolutionized excavating and material handling.

### The Newest, Finest Tractor Line on Earth . . .

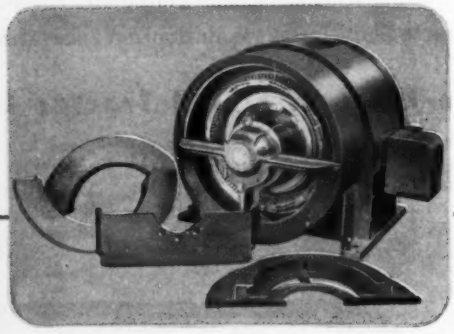
The new Allis-Chalmers tractors are not just refinements of existing models . . . *they are new from the ground up* . . . without compromise anywhere in design or materials. Back of their design are your own ideas and those of your operators and mechanics. These are combined with the vast experience of Allis-Chalmers to set new standards of Performance, Durability, Simplified Servicing, Ease of Operation.

**ALLIS-CHALMERS**
TRACTOR DIVISION · · MILWAUKEE 1 U.S.A.
*Originator of the Torque Converter Tractor*

Below is a typical forced-ventilated installation. Motor can be arranged so ducts can be brought in at any angle.



Lucite window makes brush inspection easy. Simply remove window for quick entrance to brushes . . . for checking and inspection and maintenance.



Light, sturdy end covers and air shields are easily and quickly removed for inspection and cleaning. No crane is required. One man can do the job easily.

MORE POWER PER DOLLAR

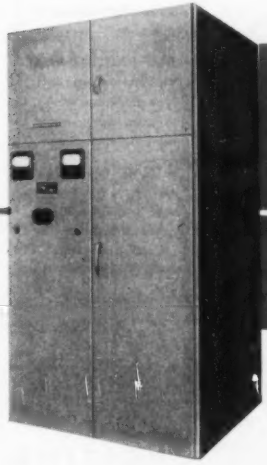
# Synchronous Motor Offers New Installation Flexibility

When forced ventilation is required you can eliminate many installation problems with this synchronous motor. Air is supplied to the motor from both ends through air inlet brackets . . . two at each end, on either side. Duct or pipe connections can be brought from above . . . from below . . . from one side or the other . . . or a combination. Thus, you can position the motor without regard for duct work.

Covers and air shields, too, add to installation flexibility. They can be easily removed — by hand — for inspection or cleaning of the motor. No crane is required. Thus motors can be mounted in hard-to-reach places.

This added installation flexibility may open up new opportunities to save money with synchronous motors. In many cases, these motors will improve your power factor and reduce your power bill. They provide more power per dollar for many types of drives than any other motor.

Get all the facts on Westinghouse Synchronous Motor savings. Ask your Westinghouse representative for information on the simplified inspection and servicing these motors offer. Complete information is available. Ask him for a copy of DB-3200 or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-10354



YOU CAN BE SURE... IF IT'S Westinghouse

SYNCHRONOUS MOTORS AND CONTROLS

Matched control for the motor. This Slipsyn Synchronous Motor Control protects your motor investment . . . helps you get more for your power dollar.

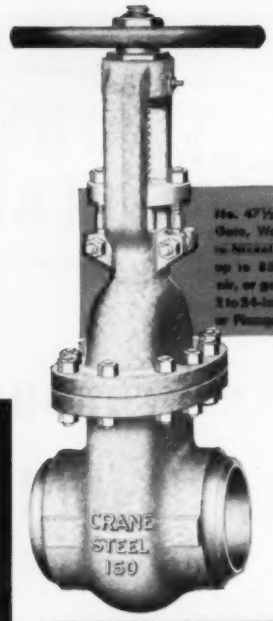
# main line dependability on auxiliary lines

## WITH CRANE STEEL GATE VALVES 150 AND 300-POUND CLASSES

Don't shortchange your power piping dollars by putting less than the best on auxiliary lines. Use dependable quality Crane Cast Steel Wedge Gates on lines such as extraction steam, condensate, heater, and suction piping. Then you can be sure they operate as efficiently as high pressure lines.

These valves are ruggedly constructed, easy to operate, require minimum routine maintenance. Body and bonnet are amply reinforced at all stress points. Trim materials are those best suited for dependable service under severe conditions.

Solid wedge disc, fully guided, reduces drag on seating surfaces. Crane body-bonnet joint gives maximum protection against gasket blow-out. Ask your Crane Representative for further details—or see your No. 49 Crane Catalog.

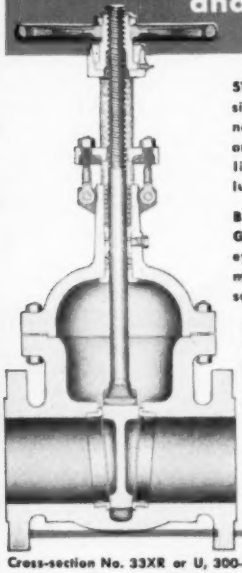



No. 47½XR, 150-pound Steel Gate, Welding Ends. Excelloy or Nickel Alloy trim. For steam up to 850° F.; for water, oil, air, or gas up to 800° F. Sizes 2 to 24-inch. Also with Screwed or Flanged Ends.

**AND FOR HIGH PRESSURE HIGH TEMPERATURE SERVICES**

use the valves that completely eliminate bonnet joint leakage and maintenance—Crane Pressure-Seal Bonnet Gates, Globes, Angles, Checks and Stop-Checks. Available in 600, 900, and 1500-Pound pressure classes. Send for Circular AD-1819 for details. No obligation.

**Easy to operate . . . and service**



**STEM THREADS**—outside valve body—are not exposed to erosive and corrosive effects of line fluids. Easy to lubricate.

**BOLTED PACKING GLAND** has swinging eye bolts, easy to remove, can't loosen in service.

**DEEP STUFFING BOX** with two-piece ball-type gland and flange, pulls up evenly, maintains tight stem seal.

**T-HEAD DISC-STEM** connection prevents side strain on stem, gives flexibility for smooth operation.

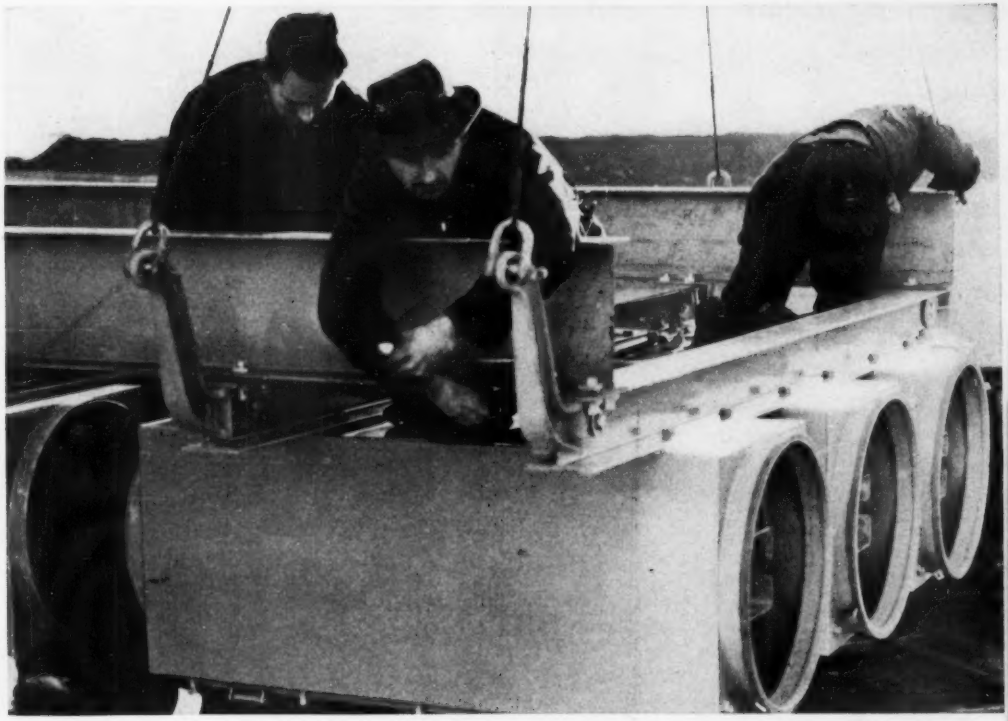
Cross-section No. 33XR or U, 300-Pound Steel Gate.

# CRANE CO.

*General Offices:*
836 S. Michigan Ave., Chicago 5, Ill.
*Branches and Wholesalers Serving All Industrial Areas*

**VALVES • FITTINGS • PIPE • PLUMBING • HEATING**

# Remove crate . . . Lift into place

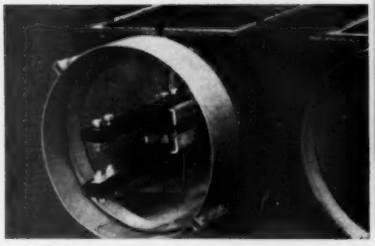


## ISOLATED-PHASE BUS SECTIONS shipped assembled, ready to install

Factory-assembled G-E isolated-phase bus sections pay off in low installation costs. Crated three-phase sections arrive ready to lift into place. You simply knock sides off crate—apply lifting brackets to "H" mounting beams and hoist into position for permanent bolting. When bus connections are made with semi-flexible connectors and sectional joints are sealed with gasketed banding rings—the job is complete!

Other advantages of G-E design include high insulation values—reduced number of creepage surfaces without sacrifice of mechanical strength—dust and water-tight hinged covers which open from either side for easy inspection.

Your G-E sales representative has complete information. Ask him for a copy of GEA-5460, a 28-page publication that will aid you in planning your buses, or write to General Electric, Schenectady 5, N.Y.



**Semi-flexible connectors join** copper buses of adjacent sections. This provides quick and easy alignment between sections. Split gasketed aluminum banding rings seal out dust and water, reduce maintenance.

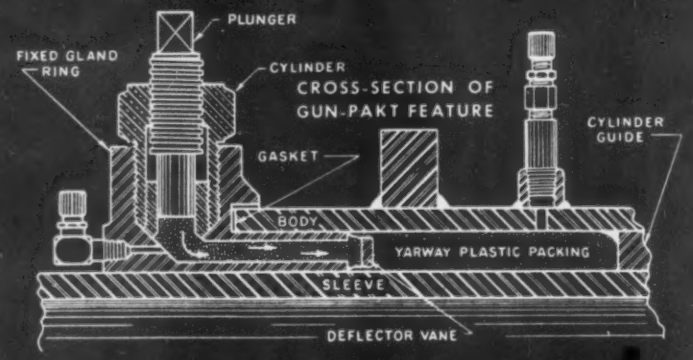
855-29

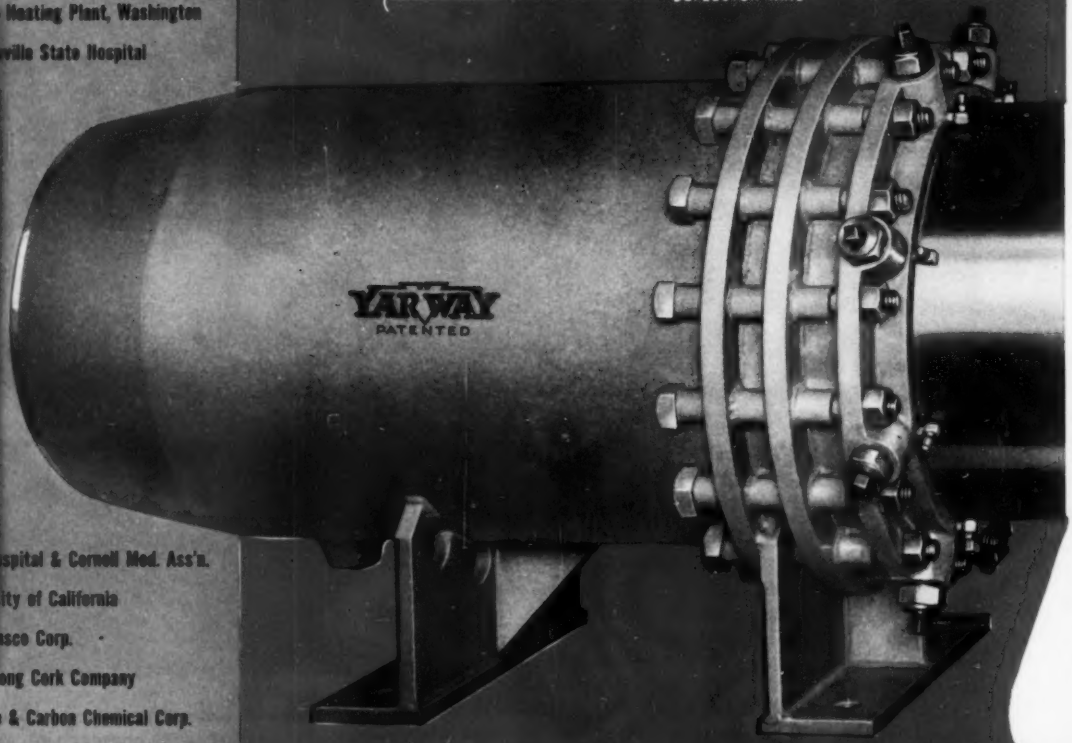
GENERAL ELECTRIC

## TYPICAL USERS

Allegheny Co. Steam Heating Company
Sanitary District of Chicago
City of Cleveland
Florida Power & Light Company
Georgia Power Company
Philadelphia Electric Company
Dayton Power & Light Company
Camarillo (Cal.) State Hospital
Central Heating Plant, Washington
Jacksonville State Hospital

# this expansion joint



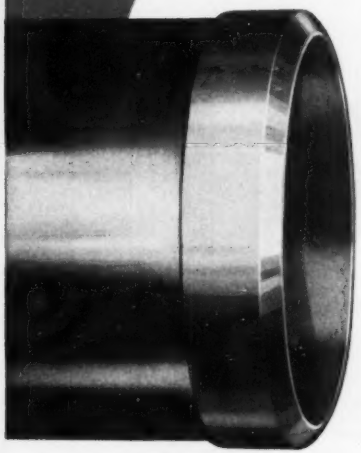




N.Y. Hospital & Cornell Med. Ass'n.
University of California
Agfa Ansco Corp.
Armstrong Cork Company
Carbide & Carbon Chemical Corp.
Chrysler Corp.
General Motors Corp. (Buick Div.)
General Motors Corp. (Chevrolet Div.)
Westinghouse Electric Co.
West Central Heating Plant, Wash., D.C.
University of Washington
Public Service Company of Colorado

YARWAY

offers...

# FREEDOM FROM SHUTDOWNS



Yarway Single-end Gun-Pakt Expansion Joint, welding type. Double-end and flanged types also available.

What feature do you want most in an expansion joint . . . sure movement, simplified installation, ease of servicing, low cost, low upkeep?

Yes, they're all important. But when you're dealing with steam under pressure, *there's nothing more important than reliability—freedom from shutdowns.*

The high factor of safety in Yarway Gun-Pakt Expansion Joints prevents shutdown losses—eliminates accident hazards.

Gun-Pakt Joints are *rugged* joints, strong and dependable. They are *serviced under full steam pressure.* Packing is added simply by inserting a plug of Yarway plastic packing and turning a wrench . . . the joint's tight, the job done.

## FEWER JOINTS NEEDED

With Yarway Gun-Pakt Joints you need fewer joints per length of pipe line. Each sliding sleeve may have a traverse of either 4", 8" or 12" . . . maximum expansion being 24" for a double-end joint.

Gun-Pakt is more than just another expansion joint—it is a revolutionary idea in expansion joint engineering. Its success is shown by wide use in leading central heating stations, institutions and industrial plants.

Get the full Gun-Pakt story . . . get Yarway Bulletin EJ-1912. Write to . . .

**YARNALL-WARING COMPANY**

100 Mermaid Avenue, Philadelphia 18, Pa.

Branch Offices in all Principal Cities

# GUN-PAKT EXPANSION JOINT

# Igloo or Jet Engine...

Wherever temperatures are important to you, there's a dependable American Thermometer or Temperature Measuring Instrument for the purpose. The line is so complete, selection for specific needs is easy, whether you require accurate temperature measuring instruments to safeguard product quality, protect equipment or control costs.

American Thermometers and Temperature Indicators and Recorders are available in ranges from minus 100°F. to plus 3000°F., with *actuation by mercury, vapor pressure, gas, bi-metal or thermocouple* —depending on instrument type and requirements. And, to indicate or record temperatures accurately as far as 250 feet from the temperature source, famous "Magic Pulse" self-compensating capillary tubing can be supplied.

Whether you must know the exact temperature of a kiln, processing vat, deep freeze – anything hot or cold – choose from the many fine American Thermometers and Temperature Measuring Instruments. New catalog gives complete details.

*Stocked and Sold By Leading Distributors*

**AMERICAN RECORDING THERMOMETERS**

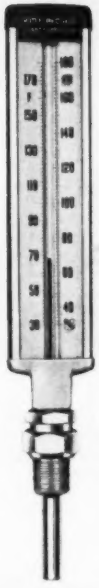
Single, double, or triple pens in round or rectangular cases. 10-inch chart with effective scale width of 3⅝" for easy, accurate reading. Chart Drive: 24-hour spring wound or electric. Actuation: mercury, vapor pressure, or gas. Ranges from minus 60°F. to plus 1000°F.

**AMERICAN TEMPERATURE INDICATORS**

A radically new pyrometric-type instrument. Combines the unique Microsen Balance with the sensitivity of thermocouple measurement. Extremely accurate, rugged, dependable. Power actuated pointer. Ranges from minus 100°F. to plus 3000°F. American Temperature Recorder also available.

**AMERICAN DIAL THERMOMETERS**

Clear, bold figures on exactly graduated dials; pointer of contrasting color. Actuation: mercury, vapor pressure, gas, or bi-metal. Ranges from minus 60°F. to plus 1000°F. Cases for stem, wall, or flush mounting.



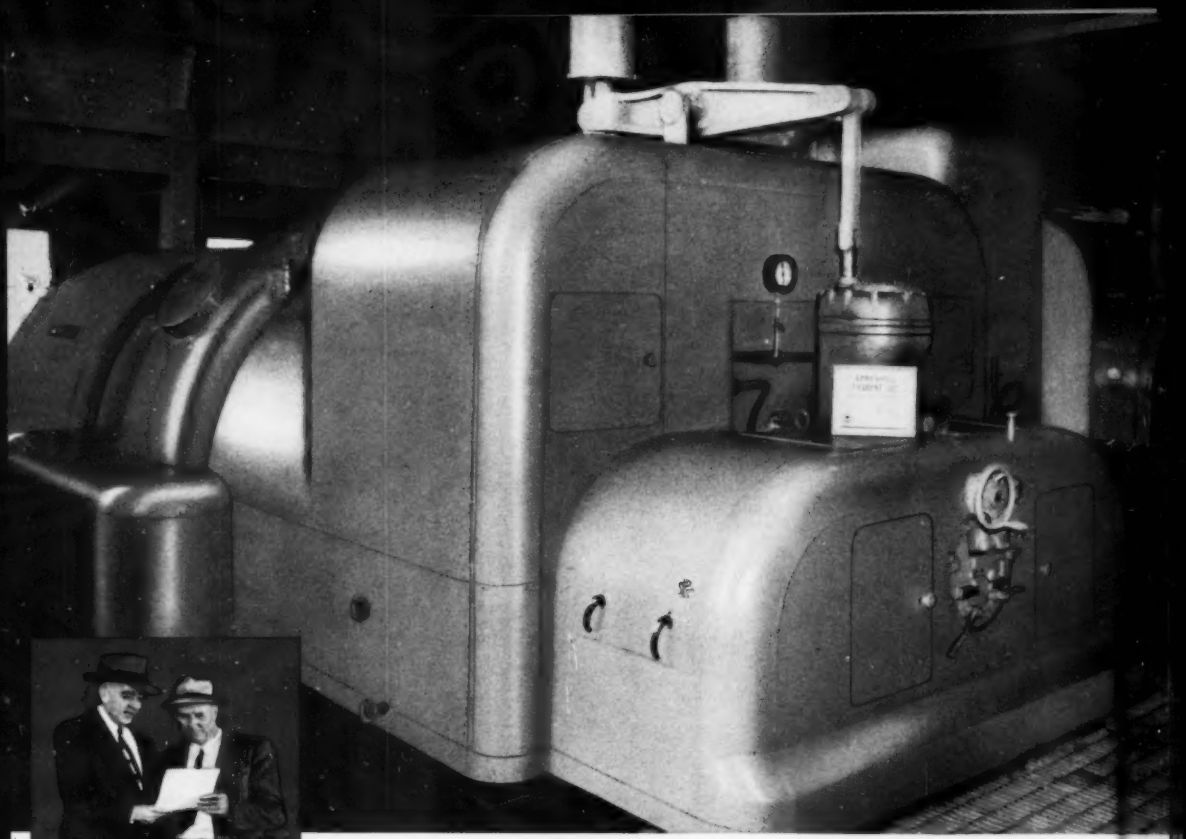
**AMERICAN INDUSTRIAL GLASS THERMOMETERS**

Full scale opening of 7", 9", or 12" with easy-to-read red mercury tubing. Ranges from minus 80°F. to plus 1150°F. Straight and angle forms.

**AMERICAN INDUSTRIAL INSTRUMENTS**

A product of **MANNING, MAXWELL & MOORE, INC.** STRATFORD, CONNECTICUT

MAKERS OF 'AMERICAN' ELECTRICAL AND INDUSTRIAL INSTRUMENTS, 'HANCOCK' VALVES, 'ASHCROFT' GAUGES, 'CONSOLIDATED' SAFETY AND RELIEF VALVES. BUILDERS OF "SHAW-BOX" CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES.



# One (good) thing leads to another

**at Coffeyville, Kansas**

Al Manis, superintendent of the Coffeyville municipal power plant, and Standard Oil (Indiana) lubrication specialist Thomas R. Smith, review the latest report on NONPAREIL Turbine Oil in service in the 10,000-KW turbine above. The neutralization number: 0.04 mg. KOH/gm.

Low acidity was one of the advantages Coffeyville engineers counted on in specifying NONPAREIL when this turbine was installed in June, 1949. NONPAREIL already had shown its resistance to deterioration, its freedom from deposits, and its elimination of acidity troubles, in the municipality's 5,000-KW turbine where it has been in service since 1945. The performance record on this first unit . . . a record including no oil replacement, no necessity to remove the oil for treatment, no downtime for cleaning of the oil system . . . was reason enough for insisting on NONPAREIL in the second turbine.

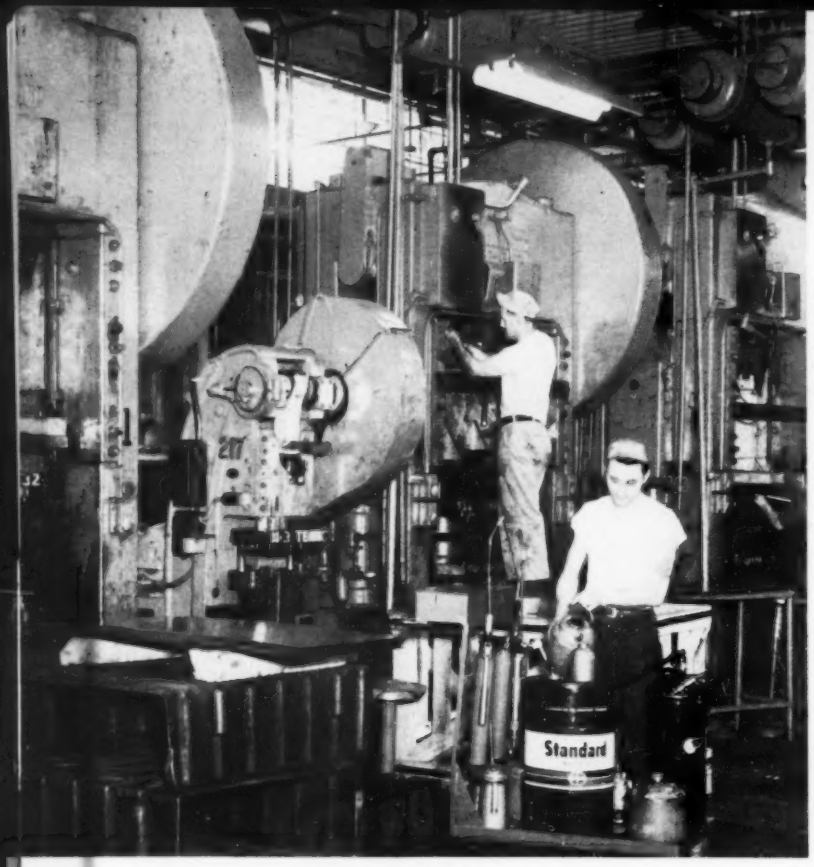
Consider what a similar lubrication performance record can mean to your own operating and maintenance costs. Consider too, that NONPAREIL Turbine Oil is guaranteed in writing to last as long as your turbine. Its neutralization number is guaranteed never to exceed 0.15 mg. KOH/gm.

For details on NONPAREIL Turbine Oil as applied to *your* turbine installation, and case studies showing the results of up to 23 years continuous trouble-free operation of NONPAREIL in other installations, call for the services of your Standard Oil lubrication specialist. You can reach him at your local Standard Oil Company (Indiana) office, or write: Standard Oil Company (Ind.), 910 S. Michigan Ave., Chicago 80, Ill.

**NONPAREIL**
TRADE MARK
**Turbine Oil**

**STANDARD OIL COMPANY (INDIANA)**

STANDARD




# No drips in this press room

WHEN plant engineers at the A. O. Smith Corporation Kankakee Works tested STANODRIP Dripless Oil No. 59 on the recommendation of a Standard Oil lubrication specialist, they found the solution for press room lubrication troubles.

STANODRIP ended the drippage of oil from bearings on stamping and punch presses. That meant cleaner and safer working conditions, less lubricant consumption, and fewer lubrication applications. As a result, STANODRIP is now used throughout the press room and is being adopted by other departments as well. "Reduced maintenance costs and longer life of our equipment are definite advantages . . . ," says Don Hartquist, Plant Engineering Supervisor.

To help put STANODRIP Dripless Oils to work wherever leakage or drippage is a problem . . . or for assistance in all phases of industrial lubrication . . . call in the Standard Oil lubrication specialist in your area. Contact your local Standard Oil Company (Indiana) office, or write: Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

**Stanodrip**
REG. U.S. PAT. OFF.
**Dripless Oil**

## What's your problem?

**C. B. Eggen** of the Standard Oil office in Joliet is the specialist who helped solve this press room lubrication problem for A. O. Smith Corporation.

With a broad background of practical experience and special training, his service is typical of the assistance available to plants located everywhere in the Midwest. Like others in the corps of Standard Oil lubrication specialists, he makes his headquarters near the plants he serves.

To take advantage of prompt, on-the-spot service in your own plant, phone or write the Standard Oil office in your area. When the lubrication specialist calls on you, be sure to get full information on these fine Standard Oil products:

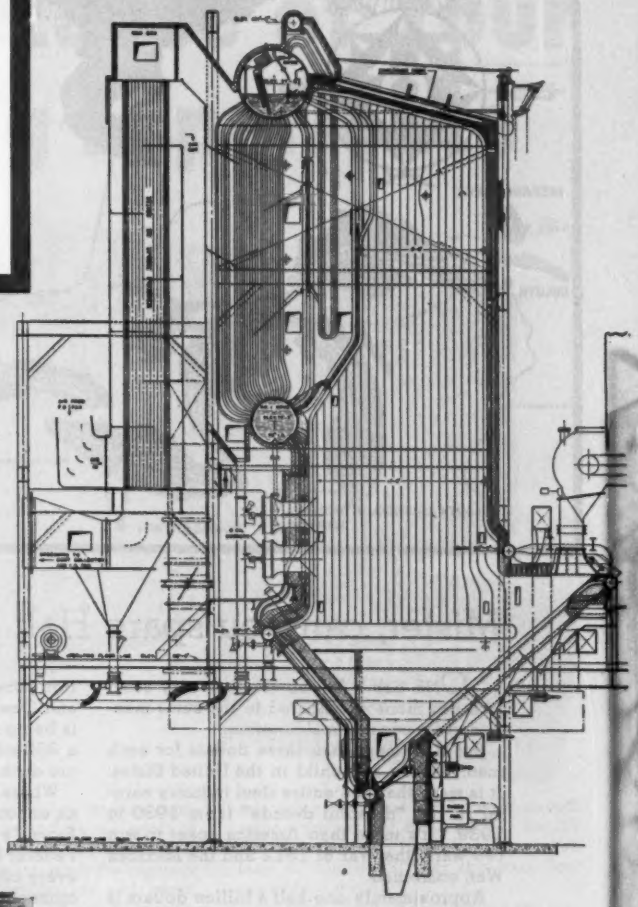
**CALUMET Viscous Lubricants**—These greases strongly resist washing and throw-off. Their superior wetting ability affords better coating of open gears and chains, better internal lubrication of wire ropes.

**STANORUST Rust Preventives**—The eight grades of STANORUSTs form one of the most complete and effective lines of rust preventives available. Each has been scientifically developed for its intended use. The grades range from a fingerprint remover to a heavy petrolatum that protects against corrosion for years under the most severe outdoor exposure.

**STANDARD OIL COMPANY** STANDARD *(Indiana)*

# STEAM GENERATING UNITS *designed to meet the needs of* INDUSTRY

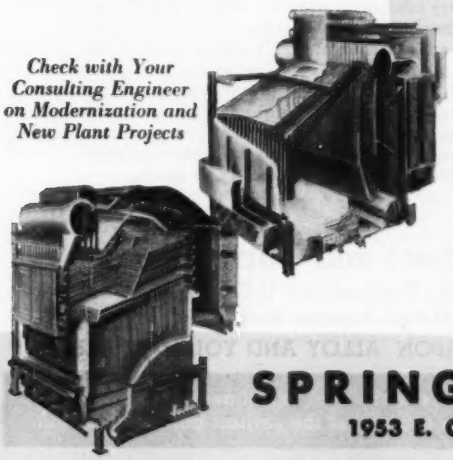
## NEW SPRINGFIELD UNIT FOR PULP AND PAPER MILL



SPRINGFIELD is building steam generating units for virtually every branch of industry: for PAPER MILLS... for TRACTOR PLANTS... for makers of FARM IMPLEMENTS...for AUTOMOTIVE PLANTS...GLASS FACTORIES...special boilers for CHEMICAL MANUFACTURERS. Shown at the right is a modern 80,000 lb. combination wood and oil fired Springfield unit installed in the power house at the pulp and paper mill of Publishers' Paper Co., Oregon City, Oregon.

Springfield specializes in the fabrication and erection of steam generating units designed to meet the user's particular requirements: ANY SIZE...ANY PRESSURE...ANY TEMPERATURE AND FOR ANY FUEL. Springfield is organized to apply the same engineering skill to all contracts, large or small. We will be glad to submit a proposal covering your requirements.

*Check with Your Consulting Engineer on Modernization and New Plant Projects*



*Location: Publishers' Paper Co., Oregon City, Ore.*
*Consulting Engineer: H. W. Beecher, Seattle, Wash.*

This unit is designed for 250 psig and operates at 200 psig with 500°F. total steam temperature at superheater outlet. In addition to superheater, it is equipped with a Springfield tubular air heater and a completely water cooled furnace, including a specially designed water cooled grate for burning wood in such a manner that the hearth tubes serve as water walls when burning oil only.

The unit is designed to deliver 80,000 lbs. per hour continuously and 110,000 lbs. per hour for two-hour peak when fired with oil only. When fired by wood and oil, it will develop 25,000 lbs. per hour on wood and 55,000 lbs. on oil firing.

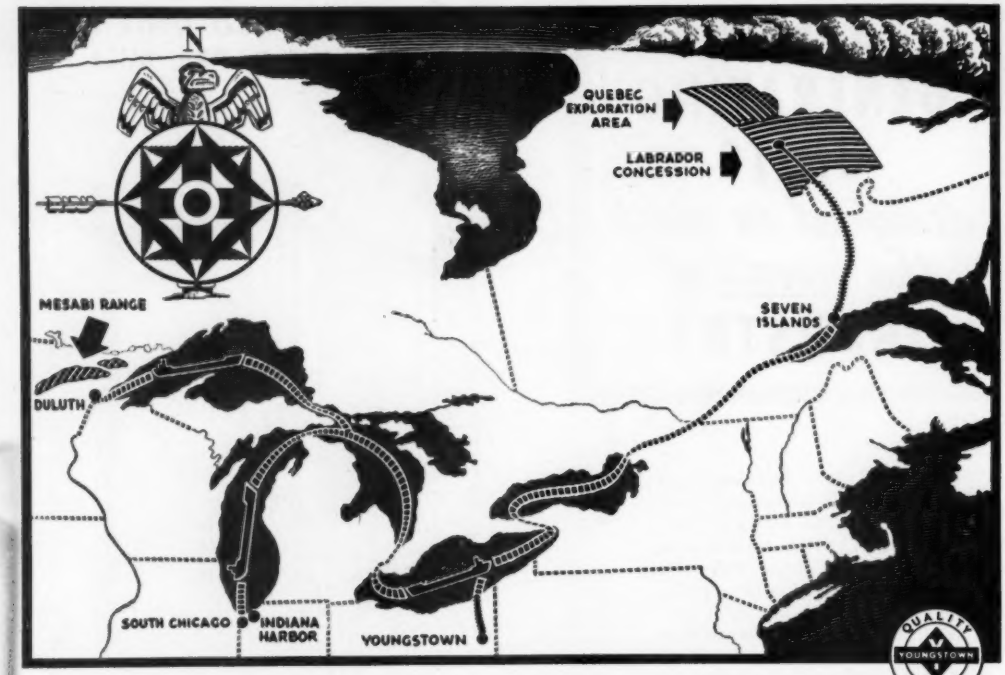
## SPRINGFIELD BOILER CO.

**1953 E. Capitol Ave., Springfield, Illinois, U.S.A.**

*Worldwide Sales and Service*

***See Our Catalog in SWEET'S***

BENT TUBE BOILERS • STRAIGHT TUBE BOILERS • SUPERHEATERS • DESUPERHEATERS • AIR HEATERS
ECONOMIZERS • WATERWALLS • PACKAGE BOILERS • COMPLETE STEAM GENERATING UNITS




# Mister, can you spare Half a Billion Dollars?

ONE half a billion dollars may seem like pin money compared to the sums mentioned for our national finances.

But it is more than three dollars for each man, woman and child in the United States. It is more than the entire steel industry earned in the "dreadful decade" from 1930 to 1939. It's more than America spent to win two wars--the War of 1812 and the Mexican War, combined.

Approximately one half a billion dollars is the estimated sum that a group of steel and mining companies, one of which is The Youngstown Sheet and Tube Company, is investing to guarantee future iron ore supplies for America. In the Mesabi iron range of Minnesota, development projects are under way which will produce millions of tons of iron concentrates from taconite. In Labrador and Quebec, a vast deposit of high grade ore is being developed. Plans include building a 360-mile railroad into the wilderness to ore docks on the St. Lawrence River.

Where does this money come from? From an unnoticed addition to our national debt? From "extra nickels" tucked away in the Federal budget? From more taxes levied on every citizen's income? *Certainly not!* Development of these ore reserves will be financed by each participating Company asking its shareholders to share in its tremendous cost.

America, in peace or in war, is served--now --and for generations to come. This is free enterprise. This is the system that created America from a wilderness and is the only sure way to keep it vigorous and strong.

Scrap Metal is Critical Again

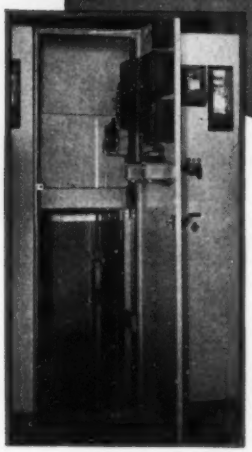
## The Youngstown Sheet and Tube Company

General Offices--Youngstown 1, Ohio
Export Offices--500 Fifth Avenue, New York

**MANUFACTURERS OF CARBON ALLOY AND YOLOY STEELS**

The steel industry is using all its resources to produce more steel, but it needs your help and needs it now. Turn in your scrap, through your regular sources, at the earliest possible moment.

# Better Because of Your Operating Experience



Welded-in floor plates provide a smooth rolling surface for your circuit breaker. Guide rails placed at each side of the breaker compartment add rigidity to the structure. A-3385

Ruptair is an Allis-Chalmers trademark.

YOU HELPED US design improvements into our switchgear. As the result of your suggestions and operating experiences, we added many new features including more panel space for instruments and relays, welded-in floor plates, wider guide rails, additional protection for wiring and made a more rigid switchgear structure. The new switchgear design is not only more functional, but it's attractive as well. It makes an impressive installation in any plant.

You requested more compartment space for mounting auxiliary equipment. So we designed a new and more spacious compartment for mounting power transformers, transfer bus and similar equipment. It permits you to make a variety of circuit arrangements in a single standard breaker unit.

You wanted to avoid special plant floors for the installation of switchgear. We designed welded-in floor plates to eliminate this requirement and still provide smooth rolling surfaces for the breakers. *Ruptair* magnetic air circuit breaker equipped with built in wheels roll over this steel floor smoothly and easily.

As the result of your experience and suggestions, special wiring is looped where flexing occurs to eliminate excessive wear. Wide full length guide rails on each side of the breaker compartment increase structural rigidity and protect wiring.

Your ideas have helped make standard Allis-Chalmers switchgear safer, stronger and better built. It's modernized to do a better protection job for you.

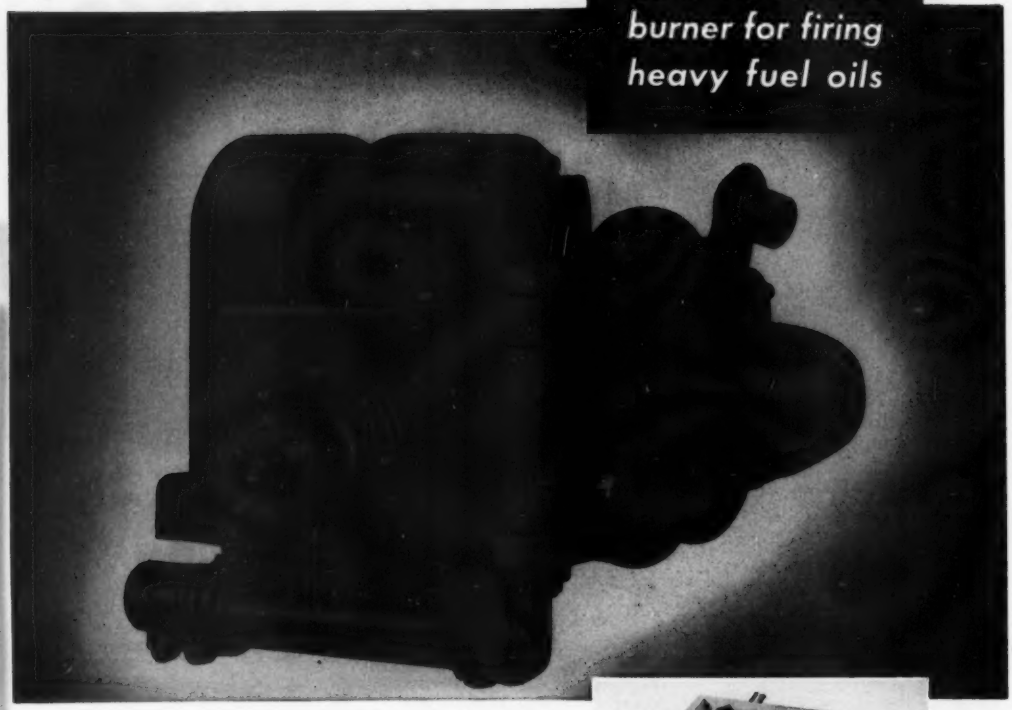
Standard Allis-Chalmers switchgear is composed of matched units, yet it can be tailor-made to suit your requirements. Get the facts today from your local Allis-Chalmers sales office. Or write direct to Allis-Chalmers, Milwaukee 1, Wisconsin.

**ALLIS-CHALMERS**

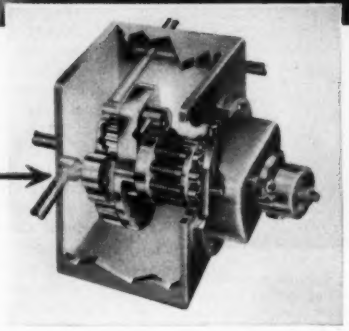
**First in the U. S. with Metal-Clad Switchgear**

# PRECISION FIRING

*Most advanced burner for firing heavy fuel oils*



**Here's the Iron Fireman Oil Volumeter that smooths out the flow of viscous heavy oils**



The Oil Volumeter is the heart of the Iron Fireman Horizontal Rotary oil burner. It is a positive displacement, variable volume metering pump, completely submerged in the oil reservoir. Multiple pistons in a rotating cylinder block pull a predetermined, adjustable amount of oil into each cylinder in turn, and discharges it at low pressure to the nozzle. The result is smooth, uniform oil delivery, dependable performance and increased economy. No viscosity compensating devices or regulating feed valves are needed.

**IRON**

**OIL, GAS and COAL FIRING**

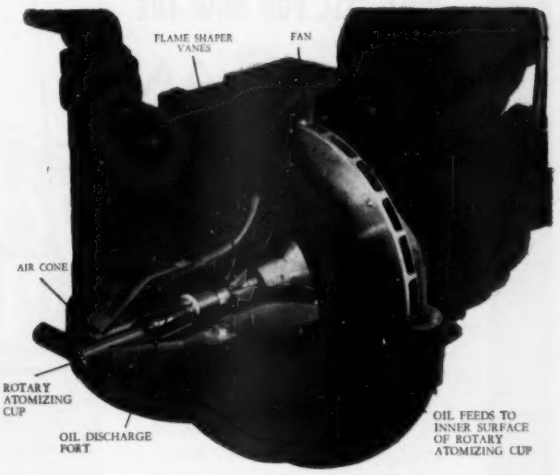
# of low cost heavy oils

## with the Iron Fireman Horizontal Rotary Oil Burner

THE Iron Fireman Horizontal Rotary oil burner gives high efficiency over a wide range of oil viscosities. In some installations the fuel has varied in consistency from No. 1 to No. 6. No special burner adjustment was required to fire these oils with a steady, uniform flame.

**Heavy oils have higher heat value**

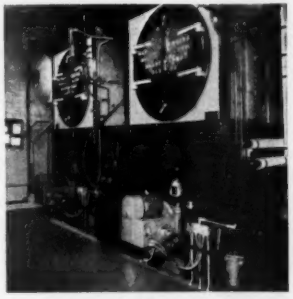
The heavy fuel oils (Nos. 5 and 6) contain up to 12% more Btu's per gallon than lighter oils, and in most areas they are lower priced. The Iron Fireman Horizontal Rotary oil burner thus offers you an opportunity to make substantial savings in fuel costs.




### Oil feed rate controlled within ½ of 1% of setting

Even when throttled down to less than 20% of capacity this burner maintains a steady flame with automatic adjustment of air-fuel ratio for most efficient firing. Firing rate is infinitely variable and is actuated by a single lever which is linked to both oil and air controls. Burner is adaptable to manual, semiautomatic or full automatic regulation. When equipped with two-position motor the burner is adaptable to automatic low flame start, or Hi-Lo flame operation. Controls and motors are also available for automatic modulating fire control, which make possible high precision firing even when boiler load fluctuates rapidly between wide limits.

For further information write for new 16-page booklet, "The Iron Fireman Horizontal Oil Burner." Iron Fireman Mfg. Co., 3133 West 106th Street, Cleveland 11, Ohio. Other plants in Portland, Oregon; Toronto, Ontario. Dealers everywhere.



**Capacities Range Up To 500 Boiler Horsepower**

***Multiple units for larger boilers***

Models are available for a very wide range of capacities, beginning as low as 18 boiler horsepower. Top capacity for a single unit (500 b.h.p.) can be extended almost indefinitely by using multiple units in a single boiler. Many such installations carry a minimum summer load by firing only one burner.

# FIREMAN

**FOR POWER, PROCESSING or HEATING**

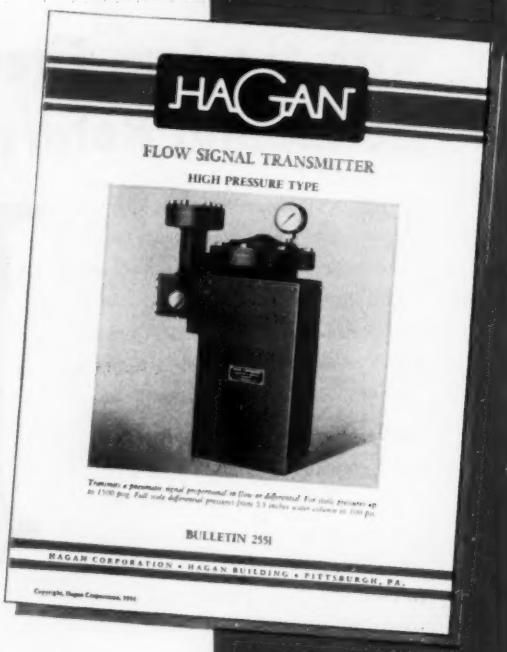
another
*FIRST*
by HAGAN

**YOUR COPY OF BULLETIN 2551 WILL TELL YOU HOW THE**

HAGAN

## Flow Signal Transmitter

**Measures pressure or flow and transmits a proportional pneumatic signal to recording or control instruments**




The Hagan Flow Signal Transmitter is a pneumatically operated sender which transmits signals in a definite relation to a measured pressure differential.

Applications include measurement of gas, vapor or liquid flow, measurement of liquid levels or absolute pressures. Differentials at full scale can run from 5" water column to 100 psi, at static pressures up to 1500 psig.

Write for Bulletin 2551, which contains details of construction and performance of the Hagan Flow Signal Transmitter. Address: Hagan Corporation, Hagan Building, Pittsburgh 30, Pa.

HAGAN

**HAGAN CORPORATION**
HAGAN BUILDING, PITTSBURGH 30, PA.

RING BALANCE HAGAN Ring Balance

combustion control systems . . . ring balance flow and pressure instruments

# THE PEERLESS TYPE A

## *Continuous Duty General Purpose* PUMP

*General Characteristics* • **SINGLE STAGE HORIZONTAL SPLIT CASE DESIGN**

**DOUBLE & SINGLE SUCTION** (Double Suction Sizes 1¼" through 48"; Single Suction Sizes 2" & 3")

**BOTTOM SUCTION** (Bottom Suction Sizes 12" through 42")

**BALL BEARING**

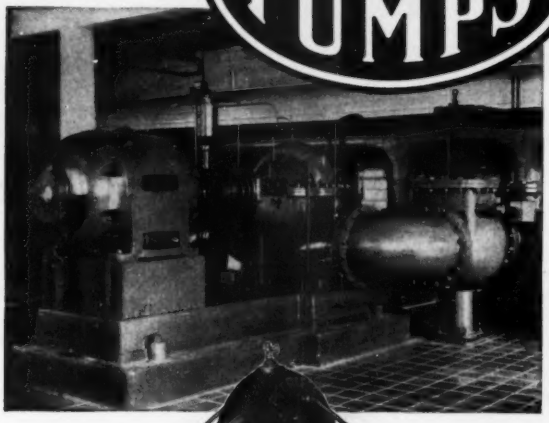
**CAPACITIES:** Up to 70,000 g.p.m.

**HEADS:** Up to 300 feet.

**DRIVES:** Direct-connected electric motor; belted drives; diesel, natural gas, and gasoline engine; steam turbine; combination drives.

**TEMPERATURES:** Handles liquids up to 300° F.

PEERLESS PUMPS



*A popular size Type A, viewed from the discharge side. The horizontally split case permits easy access to rotating elements without disturbing pump alignment or piping.*

### TYPE A *for All purpose pumping*

Peerless Type A pumps can be used in the widest variety of general pumping services, handling clear water and light alkaline fluids, where no solids are in suspension. Applications vary from pumping water for cooling engine jacket water, to providing plant water supply.

### TYPE A *for Advanced design*

Peerless Type A pumps are of the ball bearing type with horizontally split casings, for ease of inspection and maintenance. All are furnished with double suction impellers except in three small sizes where single suction design is employed. Bottom suction can be furnished in all sizes from 12" through 42".

### TYPE A *for All capacities and heads*

Peerless Type A pumps offer users greatest range in capacities, delivering up to 70,000 g.p.m. Type A characteristics permit pumping against heads up to 300 feet. Liquids of temperatures to 300°F. can be safely handled.

### TYPE A *for Ample safety factor*

The mechanical design of the Peerless Type A pump is as superior as its hydraulic characteristics. Oversize shafts, heavy duty ball bearings, modern design wear rings and shaft sleeves all contribute to ample protection against wear, afford a high factor of safety in operation and assure reliable service and extended pump life.

### TYPE A *for Accuracy in construction*

Careful attention to every detail of design is evident in the Peerless Type A pump. For example, bearing seats are cast and bored integral with the case, assuring permanent alignment. All parts are machined to gauge on an interchangeable part system and are rigidly inspected in process.

### TYPE A *for Added service life*

Every Type A pump is fully tested in Peerless' modern hydraulic testing laboratory, which can duplicate the field conditions under which the pump will be used. Experienced Peerless trained engineers located near you are at the service of pump users, architects, contractors, etc., to see that the Type A pump matches or exceeds expectations.

Write for Bulletin B-1300 describing and illustrating Type A pumps in detail.

PEERLESS PUMPS fmc

**PEERLESS PUMP DIVISION**

**FOOD MACHINERY AND CHEMICAL CORPORATION**

*Address inquiries to Factories at:*

**Los Angeles 31, California and Indianapolis 8, Indiana**

**Offices: New York, Atlanta, Fresno, Los Angeles, Chicago, St. Louis, Phoenix; Dallas, Plainview and Lubbock, Texas; Albuquerque, New Mexico.**

# . . . up to the largest

A new wave of enlightened interest in Reheat is sweeping the country as the role of the high pressure, high steam cycle promises to play an increasingly important part in power-generating facilities everywhere. Today, design developments in both boilers and turbines frequently dictate the use of the Reheat Cycle. But the spiralling cost of fuels is as much a factor as any in endearing this tool—so promising from its very beginning—to the hearts of steam-electric station operators.

Radiant superheaters and radiant reheaters were engineered and fabricated by Foster Wheeler as early as 1924 for one midwest station—considered one of the country's most efficient power plants.

The Foster Wheeler designs shown here have the following common features:

**(a)** Combination radiant and convection superheaters have a natural characteristic maintaining a constant final steam temperature over a wide load range with a minimum amount of control equipment.

**(b)** Since superheating is done partly in the radiant superheater a two-fold purpose is served. Gas temperature leaving the furnace can be reduced and danger of slagging is thus obviated.

**(c)** Steam generator characteristics are integrated with those of the turbine.

***For further information, write to:*** **FOSTER WHEELER**

1 **REHEAT**—A 770,000 lb per hr steam generator for an important midwest utility.

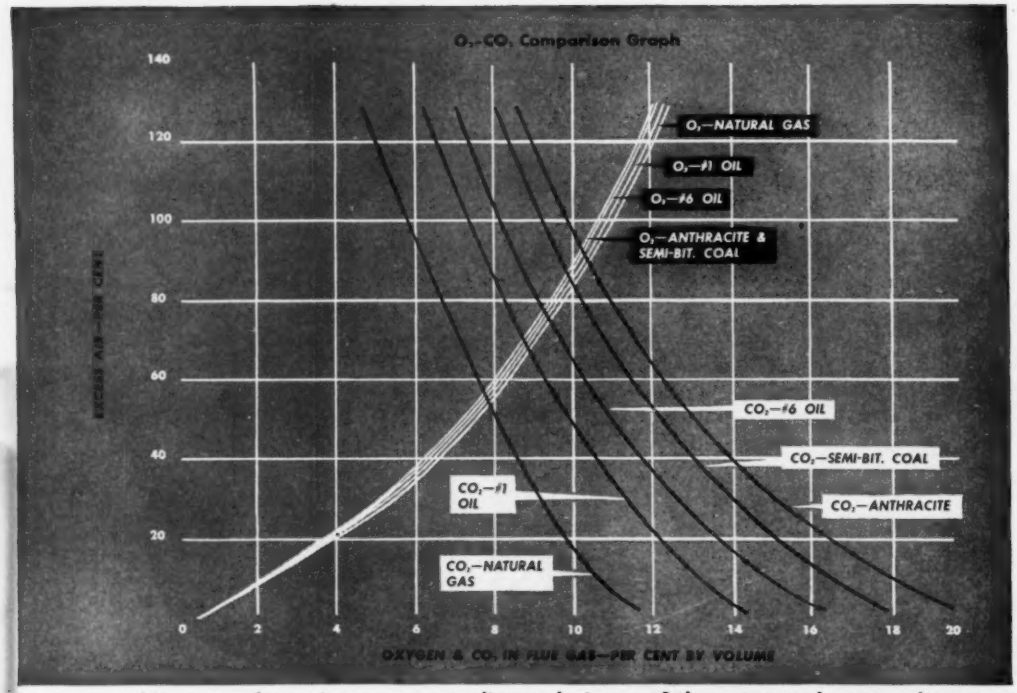
2 **REHEAT**—A 1,100,000 lb per hr steam generator for a large steam-electric station in central Pennsylvania.

3 **REHEAT AND DUAL CIRCULATION**—A 1,400,000 reheat and dual circulation steam generator for a steam-electric plant in New York City. Dual Circulation, a Foster Wheeler development, makes possible the reduction of silica carryover to negligible quantities.

CORPORATION • 165 BROADWAY, NEW YORK 6, N. Y.

FOSTER WHEELER

# How to burn Multiple Fuels efficiently




***Oxygen and Oxygen alone gives you an undistorted picture of the amount of excess air present.***

When switching from one fuel to another or burning more than one fuel at the same time, you can realize large savings with a continuous indication of Oxygen content in your flue gas—because Oxygen and Oxygen alone gives you an undistorted picture of the amount of excess air present.

This fact is borne out by the graph showing the relationship of excess air to $CO_2$ and $O_2$ in the flue gas of five common fuels. While the $O_2$ curves nearly coincide (especially in the important 30% excess air range) the $CO_2$ curves diverge widely.

### Large Savings Possible

This deviation was costing a medium sized refinery in Michigan $35-40 per day in boiler room fuel costs. Burning a combination of oil and gas they found that a combustion control system to handle their multiple fuel firing conditions would cost more than their small boilers.

They purchased a Hays Magno-Therm Oxygen Recorder, and immediately found that their boiler operation was so inefficient that the pen would not stay on the 0-10% chart. However, by operating with reference to the $O_2$ recorder they were able to reduce fuel costs enough *to pay for the instrument in 40 days.*

With the Hays Magno-Therm Oxygen Recorder you get:

**Continuous, highly accurate indication and recording.**
**Complete compensation for temperature and pressure effects.**
**Freedom from chemicals or hazardous fuel burning in the analyzing process.**
**Swift, sure electronic operation.**

If you are facing the problem of multiple fuel combustion, you will want a detailed copy of this $O_2$-$CO_2$ Comparison Graph as well as Hays Bulletin 50-829—describing the Magno-Therm Oxygen Recorder. Write for this free information.

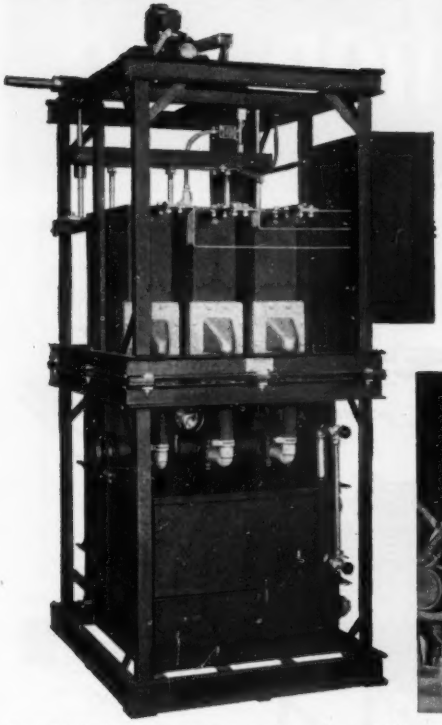
**THE HAYS CORPORATION**
*MICHIGAN CITY 3, INDIANA*

Automatic Combustion Control • Boiler Panels • Hays-Penn Flowmeters
Veriflow Meters and Veritrol • Gas Analyzers • Draft Gages
Combustion Test Sets • $CO_2$ Recorders • Electronic Oxygen Recorders

**ALLIS-CHALMERS**
Liquid Rheostat
POWER PLANT CONTROL

# Stepless Speed Control

## OF DIRECT COUPLED DRAFT FANS



Speed of the direct coupled forced draft fans shown at right is controlled by remotely located Type 257 Liquid Rheostats.

FOR PROPER DRAFT CONTROL of boilers, use Allis-Chalmers Type 257 Liquid Rheostats in the secondary of wound rotor motors driving forced or induced draft fans.

**Stepless speed control** of Type 257 Liquid Rheostats is engineered to give straight line relationship between motor speed and rheostat electrode position. Equal sensitivity of speed control over the entire regulated range is assured.

**Floor space is saved** by compact design. Only electrical connections are required. Direct coupling of fans and driving motors simplifies bearing alignment and maintenance problems . . . saves space . . . insures continuity of service.

**Low Maintenance.** Type 257 Liquid Rheostats have but few moving parts . . . no arcing contacts. Electrodes can be actuated by electric, pneumatic or hydraulic operators and give full resistance range in approximately ten inches travel.

Call your A-C representative or write Allis-Chalmers, Milwaukee 1, Wisconsin for leaflet 14S7544. A-3423

**ALLIS-CHALMERS**

### WOUND ROTOR PRIMARY MOTOR CONTROL

Make your Boiler Draft Fan Drive all Allis-Chalmers. Use the Type 257 Liquid Rheostat for secondary speed control, an Allis-Chalmers Type "H" Statter for primary control (bul. 14B6410A), and an Allis-Chalmers wound rotor motor.

### ORDER TELEGRAPH SYSTEMS

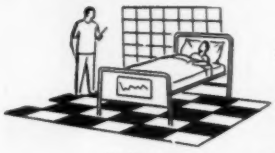
The Allis-Chalmers Order Telegraph System is accurate and reliable . . . can be depended upon even during station power failure because it uses the dc bus for its power source. An alarm system operates until the order is returned correctly. Select either five or ten-inch semi-flush dials. Use it to transmit orders between switchboard and turbine room.

# New Servel Water application and

## THE SERVEL WATER CHILLER—AN ECONOMICAL SOURCE OF CHILLED WATER OR AIR CONDITIONING

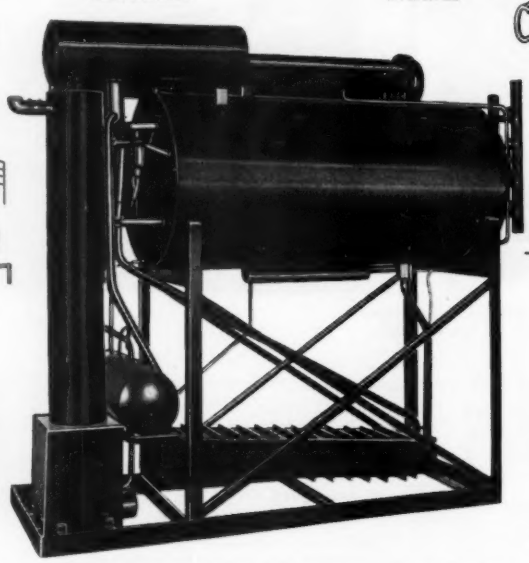
OFFICE BUILDINGS

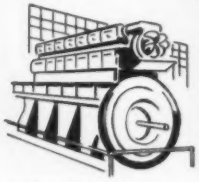
LARGE STORES



HOSPITALS

SCHOOLS

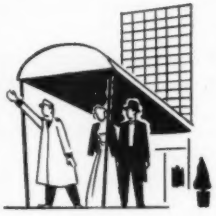




SPECIAL PRE-COOLING

FACTORIES

INDUSTRIAL PROCESSES

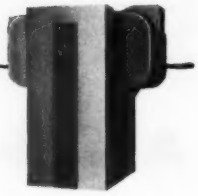


HOTELS

**DESCRIPTION:** Rated capacity under standard ASRE conditions—25 tons. Hermetically sealed absorption refrigeration system. Refrigerant, water. Absorbent, lithium bromide. Source of energy, steam. Refrigeration unit operates under a vacuum, but the chilled-water circuit operates under ordinary pump pressure.

### SERVEL STEAM-OPERATED AIR CONDITIONERS

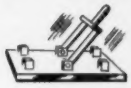
Self-Contained unit. 5 tons of refrigeration. Heating optional.
All-Year Air Conditioner. In 3-ton and 5-ton sizes. Cooling and heating.
For single or multiple installations.



# Chiller offers many operating economies

**Uses steam from any source, even *waste* steam!**

**Electric-power needs are nominal**



**Light enough to install on any floor**

**Supplies chilled water or air conditioning**

YOU'LL find it well worth while to consider the new Servel 25-Ton Water Chiller as a source of chilled water for industrial processing, or air conditioning. It's so light, quiet, and free from vibration you can install it on any floor, even the roof. You can operate it on steam from any source, at any pressure, produced with any fuel. If waste steam or waste heat is available, you can operate on it, and save most of the normal costs of fuel. And since electric-power requirements are negligible, you can usually connect it to existing electric systems.

Along with these installation economies, you get the operating benefits of Servel's famous no-moving-parts cooling system. This means dependable operation, long life, and low maintenance. You get unusually close control of temperatures, too, because you can modulate capacity as much as 50%.

Send today for full information. No obligation. And if you care to include details of your cooling or air-conditioning problem, we'll be glad to have our application engineers make suggestions.

**WHY SERVEL IS YOUR BEST AIR-CONDITIONING BUY**

• No moving parts in cooling system to wear out • Low maintenance costs • Long life • Hermetically sealed • Complete safety of operation • Chilled-water circuit operates under normal pump pressure

**SEND COUPON FOR MORE INFORMATION**

Servel

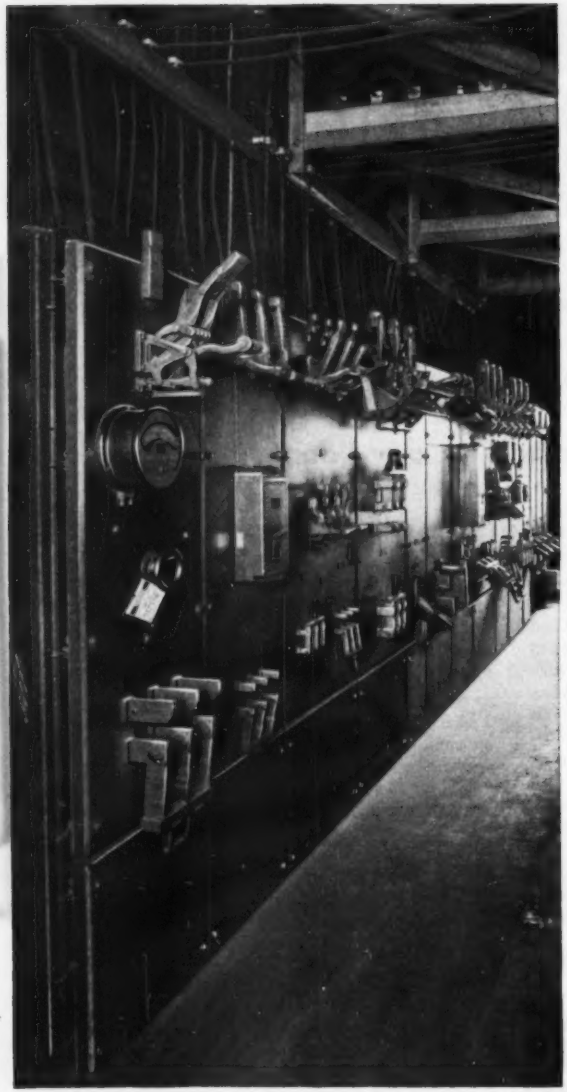
AIR CONDITIONERS

FOR INDUSTRY • FOR HOME • FOR BUSINESS

Servel, Inc.
Department X28, Evansville 20, Indiana
*Gentlemen:*
Please send me more information on the following:
Servel 25-Ton Water Chiller_____
Servel Self-Contained Air Conditioner_____
Servel 3- and 5-Ton *All-Year* Air Conditioners_____
*Name*_____
*Firm*_____
*Address*_____

**IF YOUR JOB CAN BE DONE BETTER WITH AIR CONDITIONING OR COOLING, IT CAN BE DONE BEST WITH SERVEL**

# Power bottleneck broken



**This is the old** open-type switchgear originally installed at the Traylor Engineering & Manufacturing Co. Exposed switches were a safety hazard. With extra feeders added through the years to take care of expansion, the rear of the switchboard had become a tangle of cables, inviting short circuits. Old 240-volt distribution system seriously limited future expansion.

## New G-E Metal-Clad switchgear provides for increased output, gives greater safety

## Old equipment was inadequate for growing needs

After years of service at the Traylor Engineering & Manufacturing Co., Allentown, Pa., the old-fashioned switchgear shown at left was operating on borrowed time. Already over-loaded through increasing power demands, it had become a bottleneck that limited expansion and hampered efficient production.

With interrupting devices entirely inadequate to handle the power that could be delivered under short-circuit conditions, any major fault in the system could have been disastrous.

Today this obsolete equipment has been replaced by modern G-E metal-clad switchgear. Dangerous exposed switches have vanished. Interrupting capacity is adequate to take care of abnormal conditions. And a modern high-voltage distribution system assures ample power for years to come. See opposite page.

For information on similar equipment for your plant, contact your G-E sales representative—or write for Bulletins GEA-3083 Metal-clad Switchgear; GEA-3592 Load-center Unit Substations; GEA-3758 Load-center Power Distribution. ***General Electric Company, Schenectady 5, N. Y.***

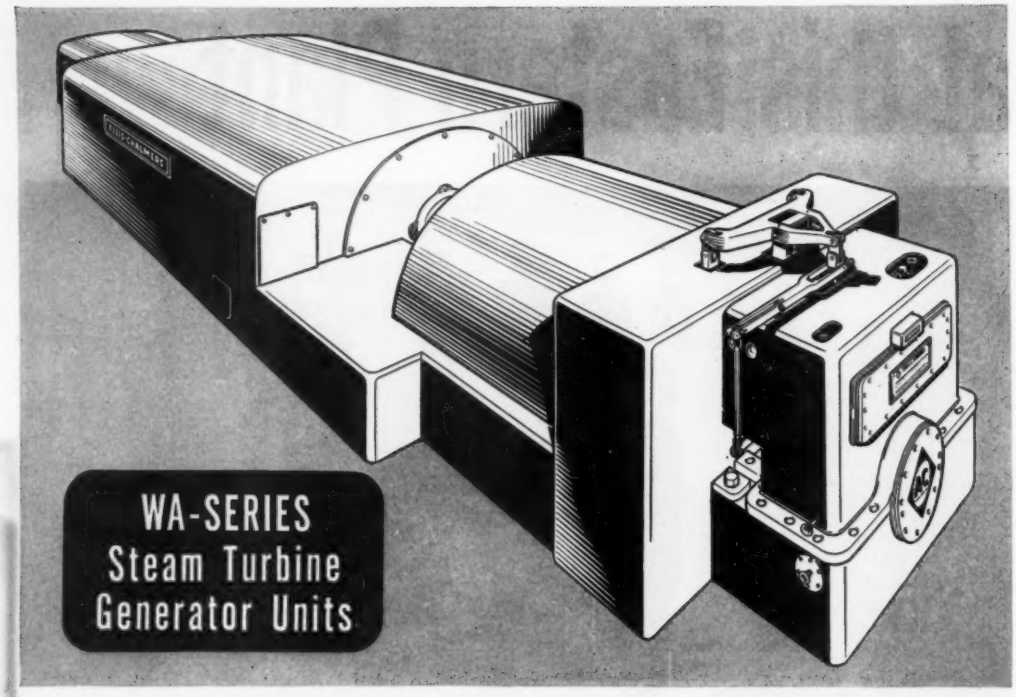
# at this Eastern Plant

**Modern G-E Metal-clad Switchgear** now installed at the Traylor Company provides greater safety because all parts are completely enclosed. For greater protection against short circuits, separate circuits are isolated in individual compartments. Circuit breakers may be easily removed for inspection, with protection for personnel. Power is distributed from this unit at 2400 volts, replacing the old 240-volt distribution system.

**Load-center Unit Substation eliminates long low-voltage feeders—saves copper.** 2400-volt power is received at this load-center unit substation and stepped down to utilization voltage on the factory floor. Because the substation is located close to the machines it serves, low-voltage feeders are short, saving copper and giving better voltage control. Discarded cable previously used for low-voltage distribution is shown at left.

GENERAL ELECTRIC

854-35




# Make Your Process Steam Serve Double Duty!

WHEN YOU'RE GENERATING process steam, you can save substantially by also generating electric power as a *by-product!*

For if you need a large amount of steam anyway, it costs only slightly more to establish higher pressure steam conditions for operating a turbine-generator unit as an efficient pressure-reducing valve. Process steam leaves the turbine at controlled pressure; power is generated as an economic by-product.

Allis-Chalmers modern WA-Series impulse steam turbine generator units are built especially for the economies inherent in such applications. WA-Series unit designs fit into your plant; tie in thermodynamically, as well as electrically paralleling with other units or systems.

They are being built in NEMA ratings through 7500 kw, for both condensing and non-condensing service, with or without automatic extraction. The WA-Series brings to the industrial and utility power plant the economies of repetitive manufacture as well as the design refinements proved by long steam turbine generator experience.

Purchaser convenience and simplicity are paramount in WA-Series design. Three-bearing construction, above-floor oil piping and bracket-bearing, housing type generator—all make a compact unit with simple foundation requirements.

Get the *full* story on the modern WA-Series! Be sure your next generating unit has *all* the latest features. Call your nearest A-C office or write to Allis-Chalmers, Milwaukee 1, Wis., for Bulletin 03B7664. A-3445

**ALLIS-CHALMERS**

TURBINES & GENERATORS | CONDENSERS & PUMPS | SWITCHGEAR & BREAKERS | MOTORS & CONTROL | TRANSFORMERS | WATER CONDITIONING

***World's Widest Range of Power Plant Equipment***

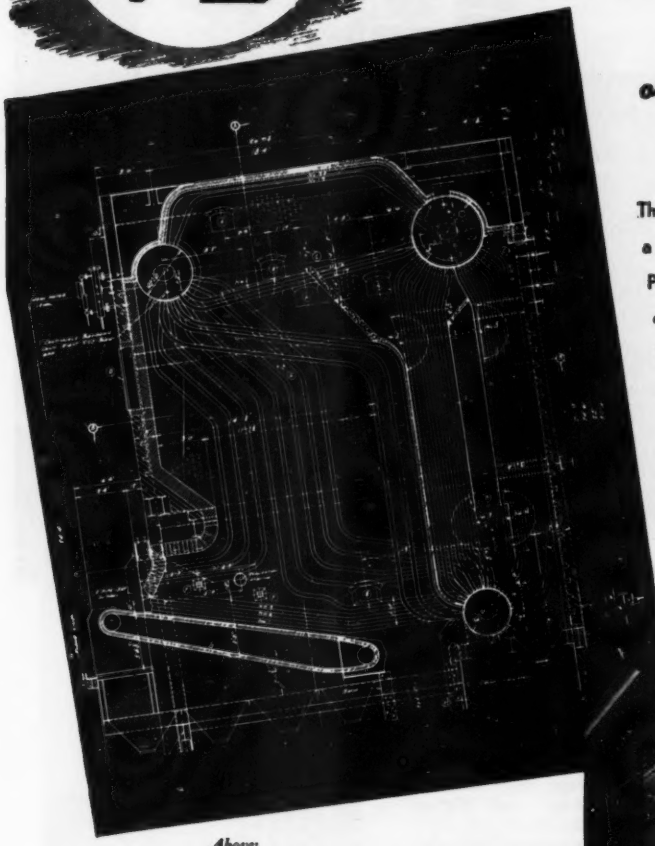
CLASS **VL**

# Vogt

# Steam Generating Units

## *for* POWER *or* PROCESSING LOADS, *and* HEATING

The design provides large furnace volume and a high ratio of radiant heating surface. Proper combustion is assured with any fuel or method of firing. Superheaters, air preheaters, economizers, water walls, and soot blowers can be readily incorporated. Vogt Class VL Steam generating units are giving satisfactory service in Hotels, Sugar Refineries, Steel Mills, Furniture Factories, Distilleries, Oil Refineries, and related industries. A bulletin showing typical installations will be sent upon request.

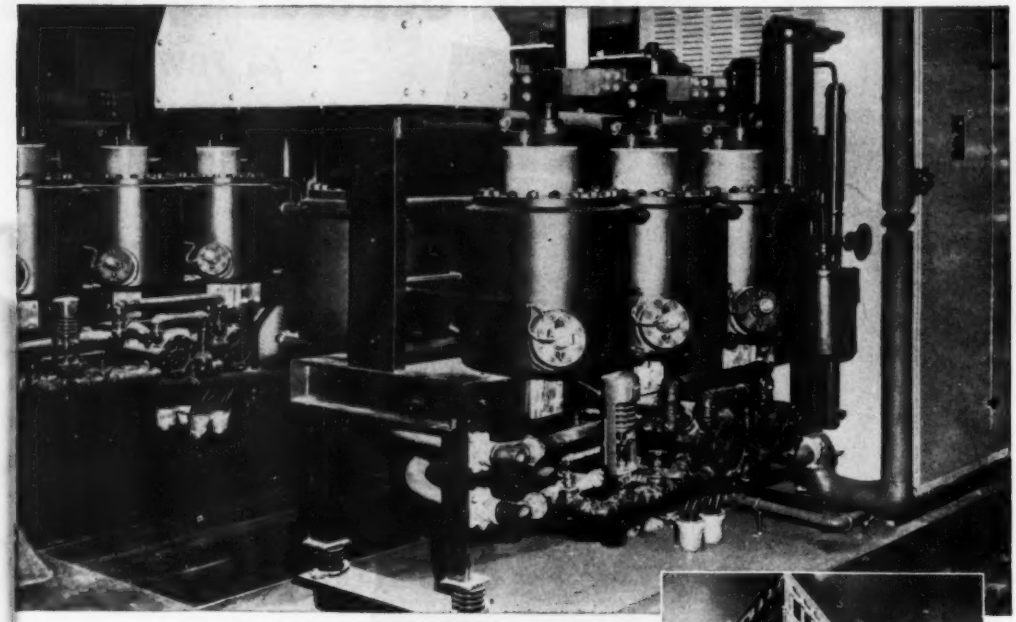


*Above:*
This 90,000 lbs. steam per hour unit, designed for 475 lbs. pressure, serves the Mansfield Tire & Rubber Co., Mansfield, Ohio.

*Right:*
Two 515 H.P. units installed in Brown-Forman Distillers Corporation, Louisville, Ky. Plant.

**HENRY VOGT MACHINE CO. • 1000 W. Ormsby St., Louisville 10, Ky.**
Branch Offices: New York, Philadelphia, Cleveland, Chicago, St. Louis, Dallas

# World's Largest Store uses 5000-kw Rectifier Installation



## Macy's replaces d-c generating plant with G-E IGNITRON RECTIFIERS

When this famous New York store decided to discard its d-c generating plant and buy power, it had a problem. A considerable portion of its equipment required d-c power but only a-c power could be bought. After considering various methods of power conversion, Macy's chose dependable, proved-in-service G-E Ignitron Rectifiers to supply the 5000 kw of d-c capacity it needed.

The G-E Ignitron Rectifiers operate 24 hours a day, 7 days a week, with minimum attention. In addition, it gives steadier, constant voltage over the entire load range and higher short-time overload capacity. Supplied as a complete packaged unit with transformer and metal-enclosed switchgear, the installation occupies minimum space.

For information on a G-E Ignitron Rectifier to fit your d-c power needs, ask your nearest G-E Sales office for a copy of bulletins GEA-5539 and GEA-5569 or write General Electric Company, Schenectady 5, N.Y.

Major portion of the power load of this huge store is supplied by the 5000 kw G-E Ignitron Rectifier installation.

324-1

GENERAL ELECTRIC

# How critical can you be?

Taylor forged and rolled steel products used in pressure vessel and boiler drum construction —welding type necks with extended necks, manways with extended neck, end flanges, domed access flange and blind flange.

You certainly have a right to be as critical as your requirements, and if those requirements happen to include pressure vessel outlets they are critical indeed.

But not too critical for Taylor Forge!

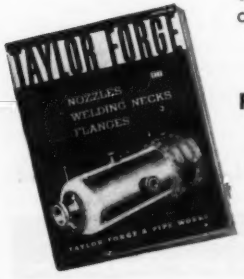
Typical Taylor Forge pressure vessel outlet fittings are illustrated above — nozzles, manways, welding necks, and related flanges. They are the embodiment of Taylor Forge engineering research and forging technique.

But whether it is the nozzle at the pressure vessel or the WeldELL or other Taylor Forge Fitting on the line, it always expresses the uncompromising standards of Taylor Forge.

How critical should you be? Just critical enough to insist on the best welding fittings all the way through, and that means Taylor Forge.

# TAYLOR FORGE

**Taylor Forge & Pipe Works** • General Offices and Works: P.O. Box 485, Chicago 90, Ill.
*Offices in all principal cities* • Plants at Carnegie, Pa.; Fontana, Calif.; Hamilton, Ont., Canada




**Facts on pressure vessel outlets**—This 118-page book covers nozzles, necks, manways and large diameter flanges; includes data on TEMA Standards and section on modern flange design. Coupon brings you copy.

☐ Send copy of Pressure vessel catalog No. 501.
☐ Send copy of welding fitting and flange catalog.

NAME_____

POSITION_____

COMPANY_____

STREET ADDRESS_____

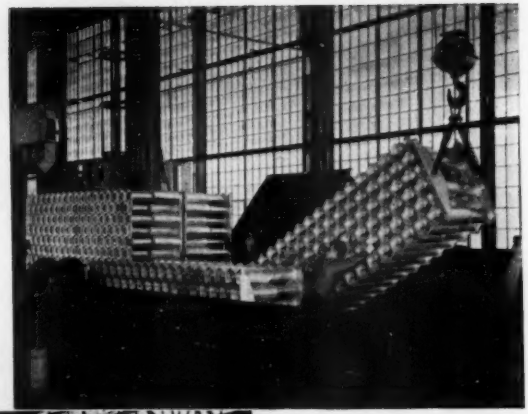
CITY_____ ZONE___ STATE_____

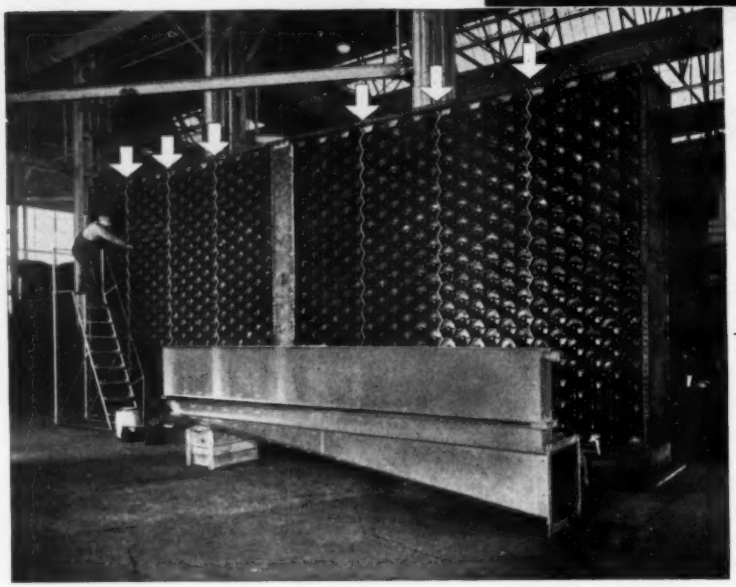
Mail to Taylor Forge & Pipe Works, P. O. Box 485, Chicago 90, Ill.

501-0851

# America's great public utilities choose American Blower Fly Ash Precipitators

**American Blower** Fly Ash Precipitators are playing an important part in the expansion programs of many major American public utilities. Years of experience in the power plant field enable us to provide equipment designed and built to handle particular problems efficiently and dependably.



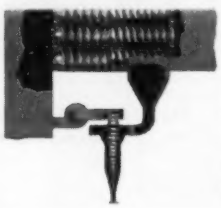


**1. Here are** sections of a *Type ST Fly Ash Precipitator* being loaded into a railroad car. Because the units are furnished partially assembled, they are easier to handle and field erection is simplified. This precipitator will be used on a 690,000# steam/hr. pulverized fuel fired boiler for a flue gas volume of 350,000 cfm.

**2. Assembled** unit receives final inspection prior to shipment. There are 816 tube elements forming 2 banks. Arrows indicate lines of mating sections which are match-marked to simplify assembly. Depending on the size or terminal velocity of fly ash particles, this Fly Ash Precipitator, when properly installed and operated, will on a normal installation remove from 85 to 90% of the fly ash.

**The simple** principle of operation of the Type ST Fly Ash Precipitator combines refinement, proportions and methods of construction which result in a more efficient, compact and economical unit.

If you have a fly ash problem and would like further information on American Blower Fly Ash Precipitators, write to our nearest Branch Office and data will be sent to you without obligation.



**Principle of Operation**

Fly ash laden gases entering main tube are forced to outside by spinner element. This action sets up centrifugal force which concentrates fly ash near tube wall. Cleaned gases in center of tube pass on through outlet tube.

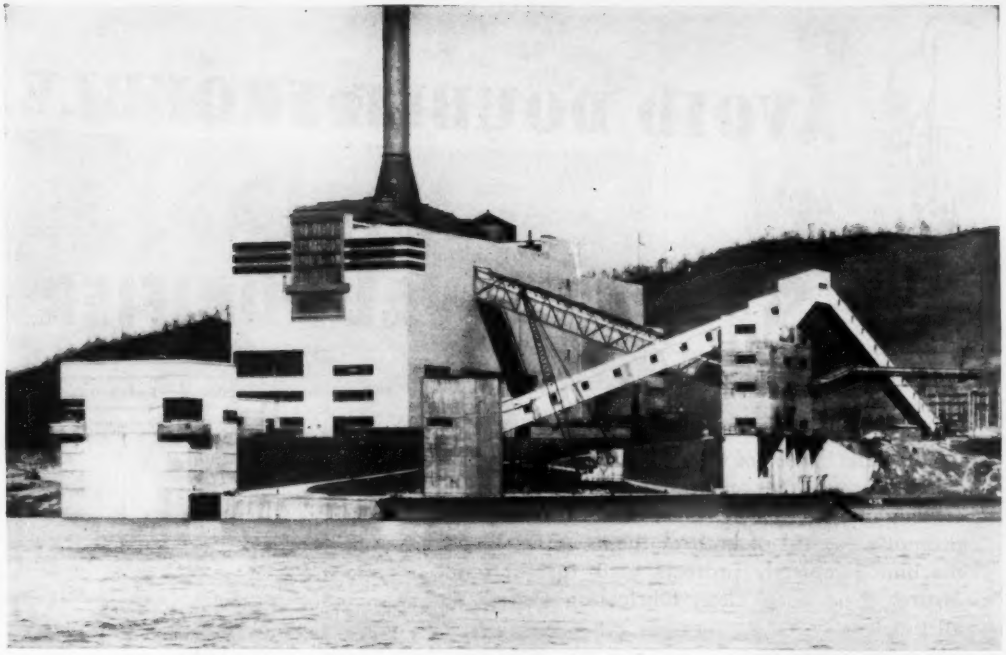
**AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN**
**CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO**

Division of American Radiator & Standard Sanitary corporation

**YOUR BEST BUY AMERICAN BLOWER POWER PLANT EQUIPMENT**

*Serving home and industry*

AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • ROSS HEATER • TONAWANDA IRON



# Unique Circulating Water System Installed in This Power Plant

The R. E. Burger steam-electric plant of Ohio Edison Company is located on the Ohio River well above flood stage—which may reach as much as 60 feet above extreme low water. Water is supplied to the condensers by a patented circulating water system pioneered jointly by Worthington and the consulting engineer, Mr. George W. Saathoff.

All major equipment except circulating pumps, which are designed to operate completely submerged if necessary, are located above flood stage.

The new installation of a Worthington 70,000 sq ft two-pass condenser and auxiliaries, serving a 90,000 kw turbine-generator, is the third Worthington unit in this station. Two 46,000 sq ft condensers were previously installed.

For advice on any new installation or information on a wide range of power plant equipment, consult Worthington Pump and Machinery Corporation, Steam Power Division, Harrison, New Jersey.

### HOW IT WORKS

Two full-capacity circulating pumps are used in series.* The primary pump, submerged below extreme low water, is a Worthington motor-driven HIFLO. Its high starting head characteristic is able to deliver enough water for starting purposes. A booster pump—a single-suction volute Worthington MIXFLO, mounted directly upon an hydraulic turbine—starts when there is enough water in the control well. The two pumps then operate automatically in series at full capacity.

Advantage is taken of maximum siphon effect from the condenser drop leg which enters the sealing or control well. From this well, all circulating water is passed through the hydraulic turbine. Thus the static head from sealing well to river level is utilized—75-80% being recovered—in reducing the work of the primary pump, with saving in overall pumping power.

The booster pump functions until rising water renders the turbine ineffective. Then the primary HIFLO works alone, producing full capacity under reduced head.

*In the new unit, there are two half-capacity primary pumps, permitting operation of only one in the winter when low water temperatures prevail.

Z.1.1

**WORTHINGTON**

**WORLD'S BROADEST LINE OF STEAM POWER PLANT AUXILIARIES**

| | | |
|---|---|---|
| Feed Water Heaters | Boiler Feed Pumps | Steam Turbines |
| Steam-Jet Ejectors | Water Treating Equipment | Surface Condensers |

# AVOID DOUBLE TROUBLE

## WITH A DE LAVAL PURIFIER

The chief causes of turbine lubricating oil contamination are dirt and water. They are double trouble-makers, but a De Laval Oil Purifier will promptly get rid of both of them. A De Laval machine ***completely*** protects your turbine, and insures a perfectly clean lubricating system at all times.

The basis of this protection is the powerful action of centrifugal force, which throws all solid particles, such as dirt, out of the oil and stores them in the bowl of the machine until cleaning time. Dirt once removed from the oil never can remix with it, nor can dirt store up within the purification zone to lessen the effectiveness of the centrifugal force. And, of course, all water that is simultaneously thrown out is discharged to waste.

De Laval protection not only is double—it is constant in efficiency during the entire length of time that the Purifier is in action.

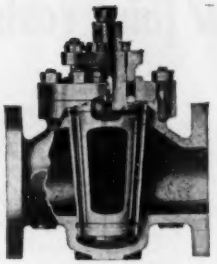
THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

De Laval

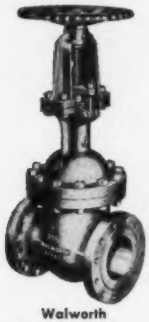
LUBRICATING OIL PURIFIERS

# • VALVES

# • PIPE FITTINGS



Walworth
Lubricated Plug Valve



Walworth
Steel Gate Valve

Walworth
Iron Body Gate Valve

Walworth
"500 Brinell" Bronze Globe Valve

Walworth
Iron Body Saddle Gate Valve

Walworth
Cast Steel Flanged Fittings

Walworth manufactures a *complete line* of valves and pipe fittings: all made to the highest standards of quality, both as to dimensional accuracy and metallurgical properties. In design, construction, and performance, Walworth products reflect more than a century of experience in the manufacture of quality valves and fittings.

Your Walworth distributor will give you full information on the *complete line* of Walworth steel, iron, and bronze, and special alloy valves and pipe fittings; also Walworth Lubricated Plug Valves, and Walseal* valves, fittings and flanges. Ask for this information today.

*Patented—Reg. U. S. Pat. Off.

**WALWORTH**

**valves and fittings**

**60 EAST 42nd STREET, NEW YORK 17, N. Y.**

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

# Low joint resistance... high resistance to corrosion

# POWER CONNECTORS

## Silver plated on all contact surfaces!

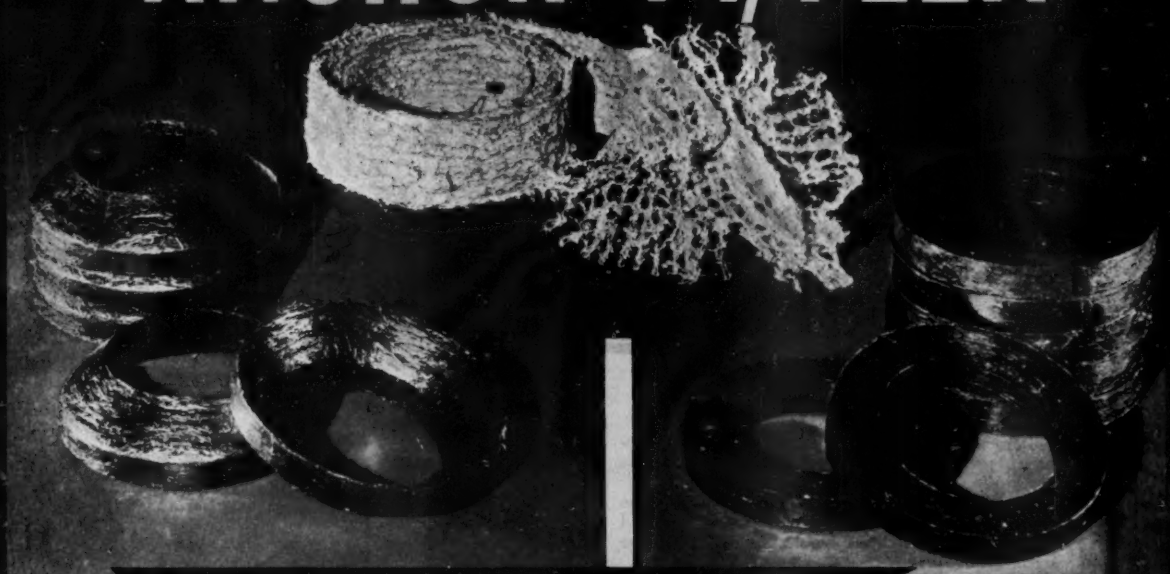
Silver on all current-carrying surfaces is just one of the ways in which G-E power connectors reduce joint resistance and minimize corrosion. Carefully regulated copper content of connector alloy provides current-carrying ability equal to that of conductor. Sharp, machine-serrated contact surfaces bite into the conductor, giving a permanent high conductivity joint that resists vibration and maintains positive pressure at all times. Interlocking sides confine the strands of the cable within the enclosure, reducing inter-strand resistance and taking full advantage of the cable's current-carrying capacity. Non-corrodible hardware of high-strength bronze alloy assures permanent tightness of connections.

There's a wide range of types—straight, tee, block, angle, parallel, expansion, ground, and many others. Why not place a trial order with your G-E sales representative? Write for Bulletin GEC-400—it contains 44 pages of valuable connector information. Section 856-57, General Electric Company, Schenectady 5, N. Y.

856-57

GENERAL ELECTRIC

# ANCHOR VY/FLEX



## . . . A Flexible Metallic Packing That Withstands HIGH Pressures . . . and HIGH Temperatures . . .

MODERN power-operated machines have created a demand for packings capable of giving service on greater pressures and temperatures than ever encountered. To meet such a need comes Anchor VY/FLEX, a highly specialized packing designed by The Anchor Packing Company to withstand the operating elements where many other packings have failed. VY/FLEX withstands most high pressures and high temperatures . . . is adaptable to a wide variety of uses. Write us today for full details.

**RECOMMENDED FOR:**

- POWER PLANTS AND STEEL MILLS
- RAILROADS
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- WATER COLUMN GASKETS
- TAR
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## THE ANCHOR PACKING COMPANY

GENERAL OFFICES: PHILADELPHIA, PA.

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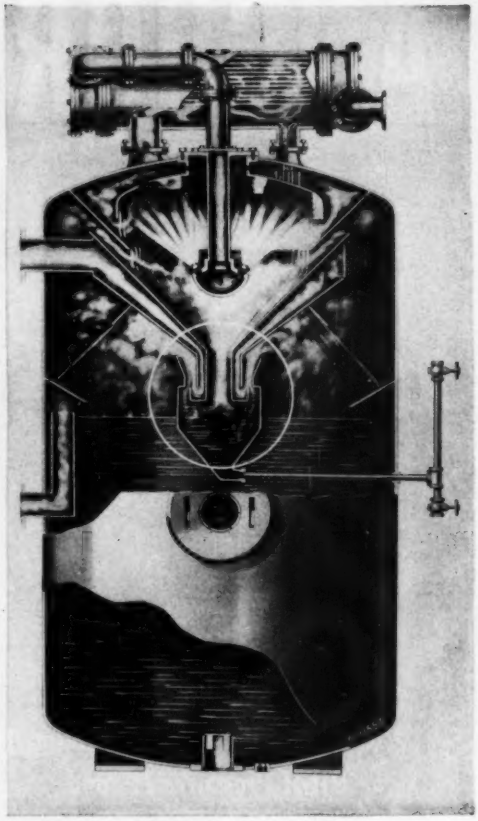
**FIBROUS AND METALLIC PACKINGS FOR EVERY INDUSTRIAL PURPOSE**



Hard scale, formed on the trays of deaerating evaporator preheaters, is no longer the big problem it used to be.

In a large central station (name on request), the preheaters had to be cleaned every three weeks, and the units were completely shut down at that time from eight to ten hours.

Then Worthington steam-jet deaerators were installed—with a "blowdown" head designed by Worthington engineers. This special head allows the operator to remove harmful deposits at regular intervals *while the unit continues in service.* It also provides for simple and speedy acid cleaning of critical parts, when necessary, without even opening an access door or removing any parts from the unit.

**Compare The "Time-Outs"**

The Worthington unit, given a short blowdown once each shift, stays in continuous operation with maximum deaeration for periods of at least 8 months. When the acid treatment is given at the end of that period, the job is finished in under three hours.

Compare this with the former record. *Then*—8 to 10 hours outage every three weeks and labor by a *crew* of men. Now—with Worthington's blowdown head—operation uninterrupted during regular short blowdown, with a shutdown for acid cleaning only once in almost a year, requiring only one man and three hours!

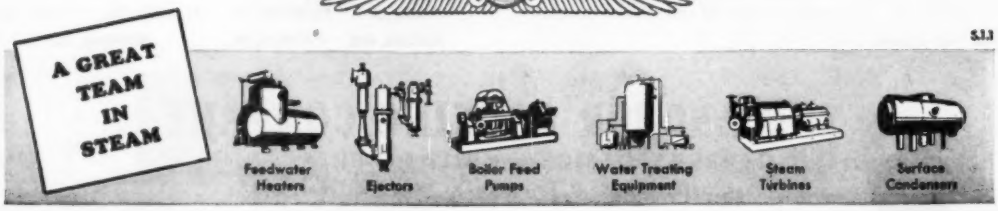
**Worthington Makes Deaerating Equipment News**

Developments like this, applicable to any deaerators operating under conditions of scaling, are typical of Worthington's engineering firsts in water treating and deaerating equipment.

Worthington manufactures all of the equipment needed in a complete water treating installation. For further information on why *there's more worth in Worthington*, address Worthington Pump and Machinery Corporation, Steam Power Div., Harrison, N.J.

# WORTHINGTON

S.J.J

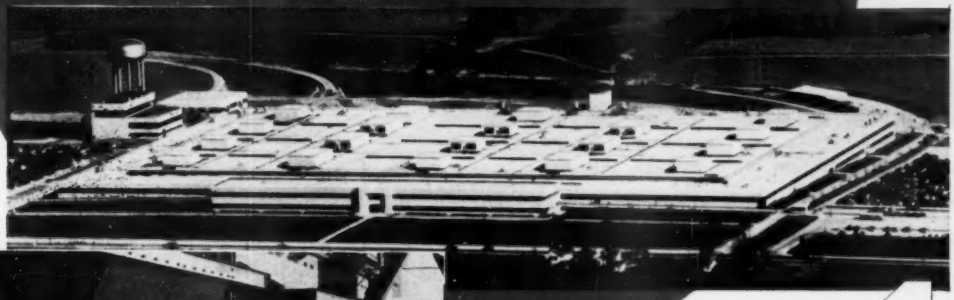


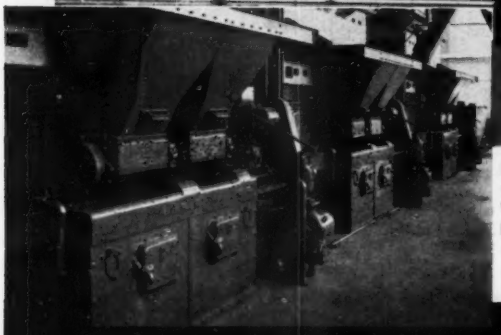
Western Electric dialed the right number

Western Electric engineers dialed the right number when they selected Detroit RotoGrate Stokers for their new Indianapolis Plant—the world's largest factory devoted to making tele-[illegible]nts.

Detroit [illegible]Grate is the original spreader stoker with forward moving grates that discharge ash at the front. It burns any Bituminous coal or Lignite and may be adjusted from one fuel to another. Periodic higher burning rates to produce more capacity per foot of furnace width.

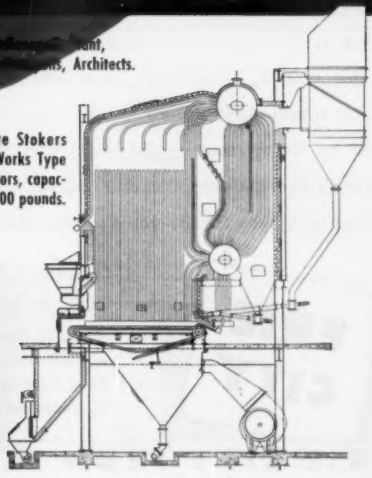
RotoGrate Stokers easily handle fluctuating loads—have a record of exceptional efficiency with a wide variety of installations. • Write for Bulletin.





Western Electric Indianapolis Plant, [illegible], Architects.

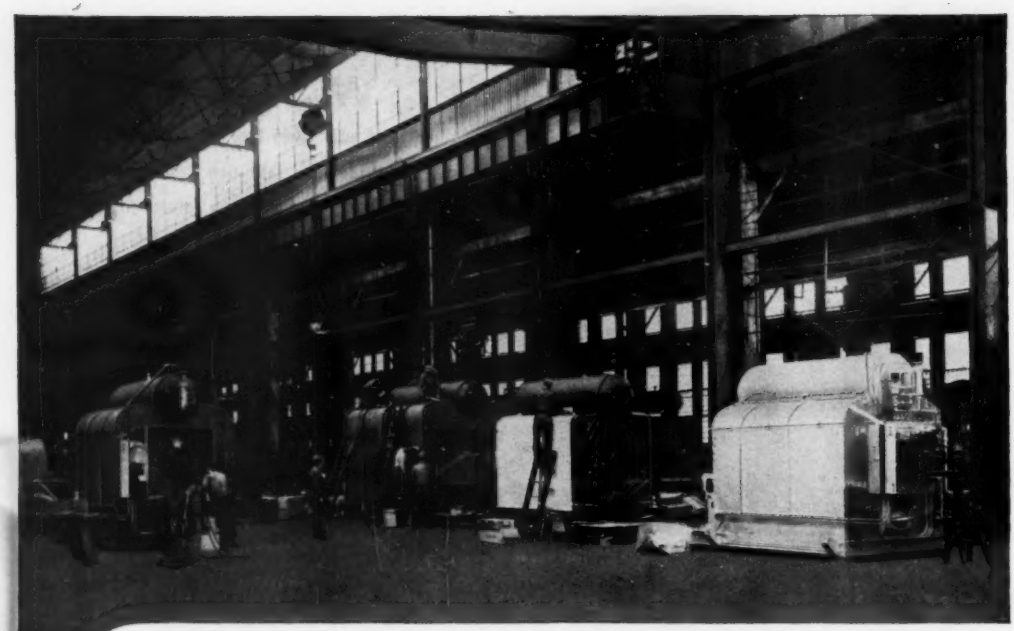
Detroit RotoGrate Stokers with Union Iron Works Type VO steam generators, capacity each unit, 60,000 pounds.



DETROIT STOKER COMPANY

General Motors Building—Detroit 2, Michigan

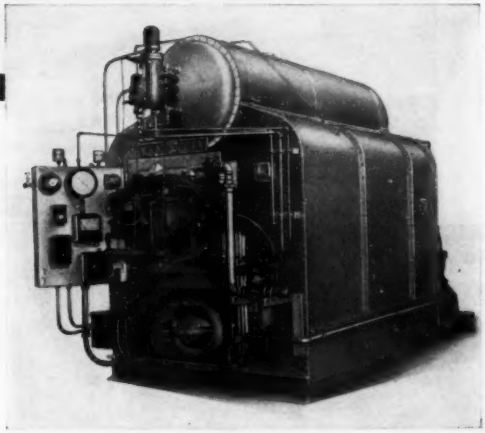
*District Offices in Principal Cities • Works at Monroe, Michigan*



# KEYSTONE STEAM GENERATORS
## . . . *are* ON THE MOVE

. . . the steady flow of "Keystones" thru our shops at Erie indicates the wide acceptance of a new idea in steam generation—they are compact 2-drum water tube boilers with integral furnace and automatic firing.

This unique "packaged" boiler design provides quick installation of new steam capacity in the field by simply making the usual service connections. Complete description and dimensions are contained in Bulletin SB-38—yours for the asking.



Typical of the 13 standardized sizes is the above 150 h.p. Erie City Keystone Steam Generator. These are available from 75 to 800 h.p. for pressures from 160 psi.

COMPLETE STEAM POWER PLANT EQUIPMENT

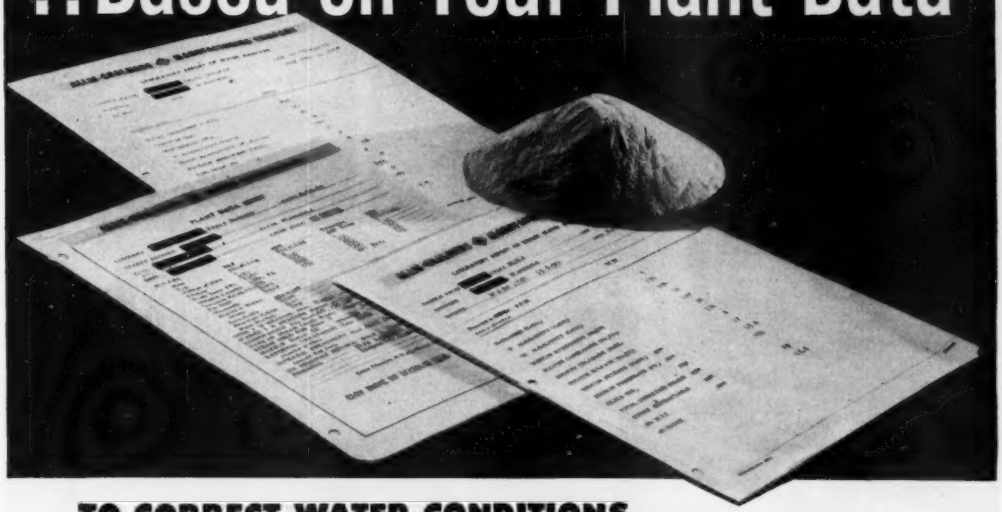
**ERIE CITY**

Complete Steam Generators • Type C 3-Drum Boilers • Types VL & VC 2-Drum Boilers • "Economic" Boiler with or without Water Walls • Welded H. R. T. Boilers • Welded Steel Heating Boilers • "Keystone" Packaged Steam Generators • Coal Pulverizers • Underfeed and Spreader Stokers • Welded Pressure Vessels for the Process Industries.

**ERIE CITY IRON WORKS • ERIE, PA. •** *Since 1840*

# ALLIS-CHALMERS
## No. 30 SERIES
### Boiler Feedwater Treatment

# ..Based on Your Plant Data



## TO CORRECT WATER CONDITIONS USE THE CORRECT TREATMENT

THE RIGHT PROTECTION in the right amount is given by Allis-Chalmers No. 30 Series powder formulations — protection against scale, corrosion and embrittlement (if required). The materials used, their proportions and the rate of feeding are prescribed by Allis-Chalmers specialists, and each formulation is based on the characteristics of the plant it is to serve.

There are no secrets connected with No. 30 Series treatments. These formulations are the logical chemicals in the proper proportions to control undesirable elements revealed by a study of your plant data. No stock "boiler compound" can equal this straightforward, effective internal treatment for boilers in the low and medium pressure ranges.

A trial period for a No. 30 Series treatment can be arranged for your plant if our studies indicate that it will prove helpful.

FOR A COMPLETE, BRIEF discussion of the Allis-Chalmers No. 30 Series internal treatments, send for bulletin number 28X7531. If you wish, your nearby Allis-Chalmers office can arrange to have your water problem brought before our specialists for study.

**Allis-Chalmers**
**Milwaukee 1, Wisconsin**

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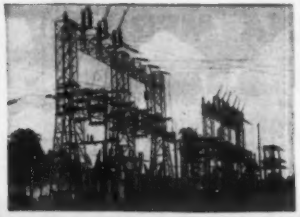
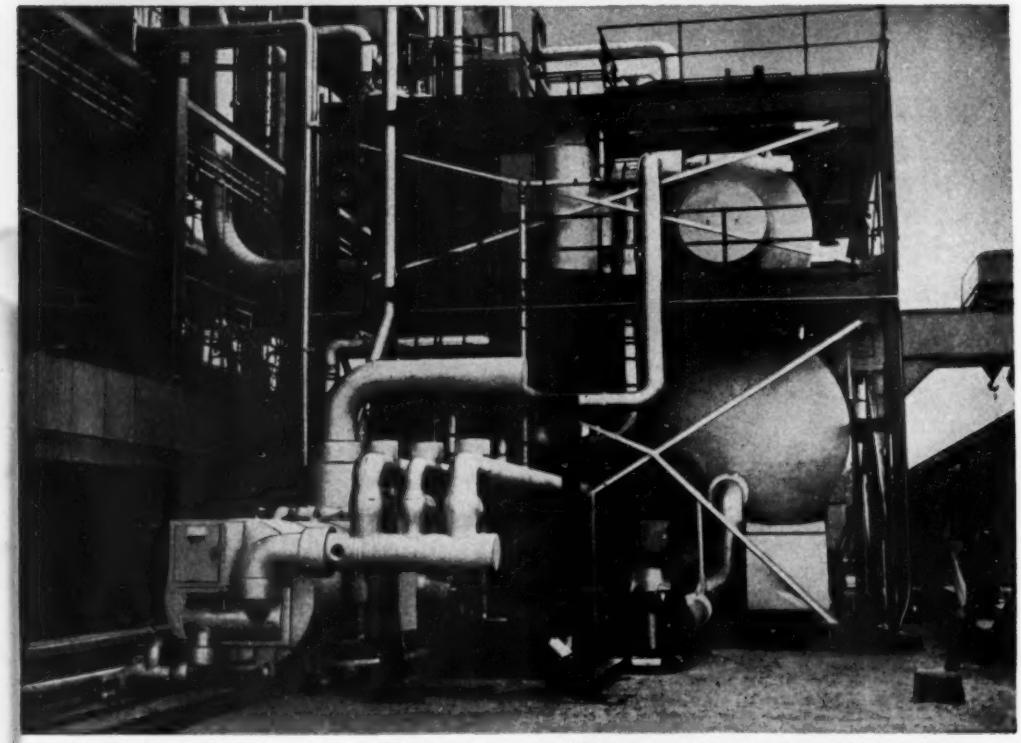
# ALLIS-CHALMERS
## Water Conditioning
✓ EQUIPMENT ✓ CHEMICALS ✓ SERVICE



# *Where heat is a production tool!*

## —Carolina Power and Light Company uses K&M Insulations in Lumberton Plant



Steam plant, Carolina Power and Light Co. Lumberton Station. Shown are evaporator, evaporator pre-heater, deaerating heater, and storage tank. "Featherweight" 85% Magnesia used to insulate surfaces up to 600°F.; used in combination, with K&M Hy-Temp to insulate surfaces above 600°. Weatherproof finish. ENGINEERS AND CONSTRUCTORS: Ebasco Service, Inc., INSULATION CONTRACTORS: Guy M. Beaty Company, Charlotte, N.C.

## These Keasbey & Mattison Insulations deliver more steam at less cost!

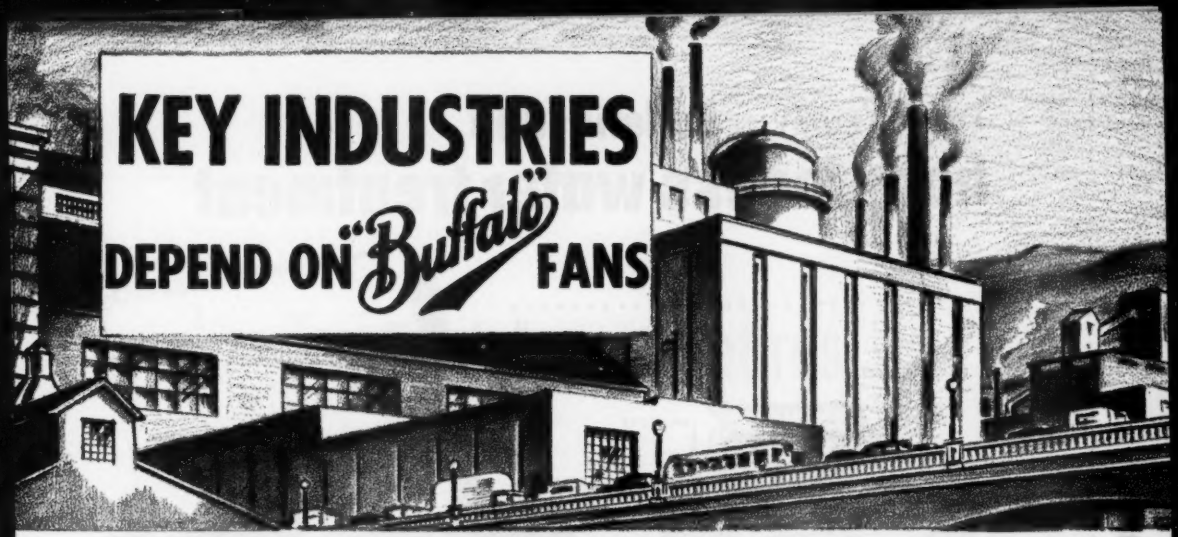
You'll find Keasbey & Mattison insulations—K&M "Featherweight" 85% Magnesia, and K&M Hy-Temp—wherever exacting steam temperature control is a must—in power stations, steamships, oil refineries, chemical plants, hospitals. These two insulations have a reputation for their cost cutting services—"Featherweight" 85% Magnesia for temperatures up to 600°F.; and in combination with K&M Hy-Temp Insulation when difficult heat control situations arise in the temperature range from 600°F. to 1900°F.

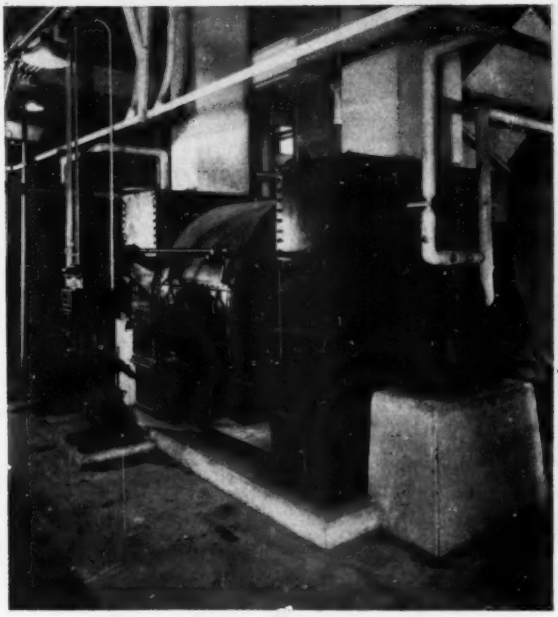
Your Keasbey & Mattison Distributor, who is an experienced applicator, will be glad to give you complete information on any of the K&M Insulations for the 40°F. to 1900°F. service range. Or, write us.

*Nature made Asbestos...*
*Keasbey & Mattison has made it serve mankind since 1873*

**KEASBEY & MATTISON**
**COMPANY • AMBLER • PENNSYLVANIA**

*In Canada:* **ATLAS ASBESTOS CO., LTD., MONTREAL, TORONTO, WINNIPEG, and VANCOUVER**



## WHERE RUGGEDNESS MEANS ECONOMY!

Above photo of "Buffalo" Induced Draft Fan in Interstate Power Company's Lansing station, Lansing, Iowa, shows rugged construction. Induced draft is one of the severest services to which a fan can be subjected. It's ALWAYS an economical policy to specify "Buffalo" Fans, because they *last* on the job!

## INTERSTATE POWER CO. USES "BUFFALO" FANS FOR EFFICIENT COMBUSTION

Power generation, key industry in industrial America, must be efficient!

This is why well-run power companies like *Interstate* have chosen "Buffalo" Draft Fans. They are heavily built where wear occurs, which means longer operating periods without replacements. They are built with all parts accessible for quick servicing and minimum down-time. High efficiencies mean driving economy, and pressure characteristics are stable over a wide range of capacities. "Buffalo" Induced Draft Fans are designed for best efficiency with high static pressure and comparatively low velocity through rotor, housing and fan cutoff, greatly reducing erosion. "Buffalo" Forced Draft Fans deliver rated air capacity even if fuel bed load is unusually heavy. *WRITE FOR BULLETIN 3750, shown, for complete facts.*

"Buffalo" FIRST FOR FANS

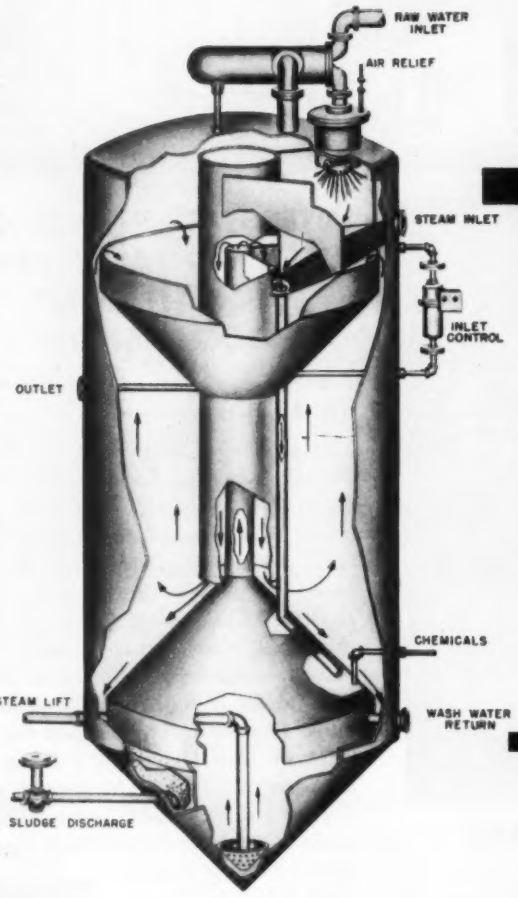
# BUFFALO FORGE COMPANY

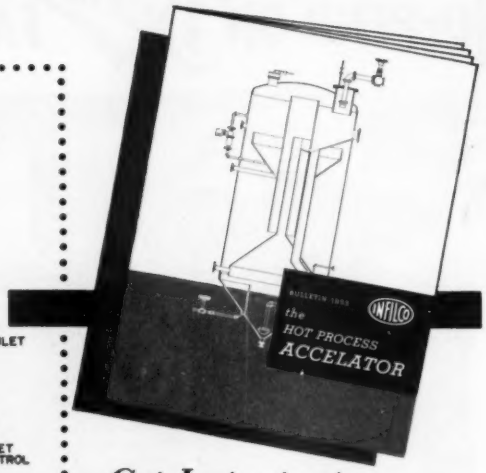
488 BROADWAY · BUFFALO, NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont., Branch Offices in all Principal Cities

VENTILATING FORCED DRAFT · AIR WASHING COOLING · AIR TEMPERING HEATING · INDUCED DRAFT EXHAUSTING PRESSURE BLOWING

# *Now Ready...* bulletin 1855
# hot process water treatment




## *Get Important New Facts on:*

1 Chemistry of boiler feedwater treatment
2 Hot Process softening and deaeration
3 Advantages and limitations
4 Accessory equipment
5 Typical installations (including drawings)

**SEND NOW FOR INFILCO BULLETIN 1855**

Contains data based on 50 years' experience in softening and treating water.

HOT PROCESS

**Accelator**®

offers self-contained deaeration — controlled slurry recirculation — maximum silica reduction — chemical economy. Fully described in Bulletin 1855

INFILCO

BETTER WATER CONDITIONING AND WASTE TREATMENT SINCE 1894

**INFILCO INCORPORATED** | *Tucson, Arizona*

FIELD ENGINEERING OFFICES IN 26 PRINCIPAL CITIES

*World's Leading Manufacturers of Water Conditioning and Waste-Treating Equipment*

Power
COMBINED WITH OPERATING ENGINEER

# Fred Annett Retires

STILL GOING STRONG after 35 years of outstanding service to the readers of POWER, Fred Annett, senior Associate Editor, will retire on August 1 to devote himself to the revision of his technical books and to take life a little easier than is possible on the POWER staff.

He does this at the peak of his creative powers, with his youthful vision and enthusiasm undimmed.

The decision was his, not ours. And, characteristically, it came to us many months ago. Fred simply said, "I have decided . . .," and that was that; nobody can change his mind in matters of this sort. At every crossroad of his life he has faced the facts, reached his own decision and then followed through.

This pattern has never varied from that distant day when a tousle-headed Canadian lad picking potatoes decided that 25 cents per day was poor pay and headed for the greater challenge and higher rewards of the sawmill. Riding the saw carriage, Fred made good—broke the world's record for number of board feet of lumber cut from logs in one day.

Then came other decisions—each followed through to success: railroading while sweating out an education—gaining practical experience in electrical maintenance—teaching practical electricity.

Thus, by sweat and midnight oil, he built a solid foundation for an editorial career, although he had never anticipated the invitation to join POWER's staff in 1916.

A great engineer is not necessarily a great editor, but Fred was no man to be content with mediocrity in anything he tackled. At the very start he earned recognition by an electrical study course still remembered by old-time POWER readers. From then on he mastered one great subject field after another—hydro power, pumps, elevators, instruments and controls, mechanical power transmission. In each of these specialties he earned an international reputation. And he found the time and knowledge to author enduring books on electrical machinery, direct-current motors, elevators and pumps. In all they have sold more than 200,000 copies.

Yet Fred Annett is far more than a "walking encyclopedia" of practical engineering. He is also a driver, a self-starter and a go-getter. Again and again he hops the plane for a flight to his native Canada. In quantity and quality the data he brings back sometimes shame his younger associates—as does his habit of getting his editorial work completed long before it is needed.

All in all, we who know him best see Fred Annett as one man in ten thousand. We would hardly know where to turn to find an equal combination of technical knowledge, wisdom, concentration, gumption and homespun practicality.

He happens to be an engineer and an editor, but his qualities would have won him distinction in any profession. He could have been a great surgeon, a world authority on the stars or a topnotch historian.

So, on August 1, Fred Annett will shed the editorial harness to revise his books and have more leisure. We are pretty sure how the spare time will be spent. Much will be devoted to his wife. Fred puts it this way: "Mamma hasn't had enough of my companionship all these years." He will keep on tending his flowers and trees, and feeding bushels of grain to his migrating birds. He will read up on ancient civilizations and watch current events with a keen and mistrustful eye.

It is also our hunch that Fred Annett will not be able to resist our urgent invitation to keep his hand in POWER through frequent pages from his sure pen. So he will still be a working member of our team.

The whole staff of POWER joins me in a salute to a great editor, a beloved associate and a wonderful man.

**Phil Swain**

# Only Edward Has Integral Seats

## FOR ALL HIGH PRESSURE—HIGH TEMPERATURE REQUIREMENTS

**Pioneer in the valve industry in the use of Stellite hard facing for seats and disks, only Edward has the experience and the intricate equipment to build trouble-free extreme service valves with integral hard facing in a full size range.**

**No more leakage between valve seats and bodies, no more loosened or distorted seats, regardless of pipe size, service, or valve type.**

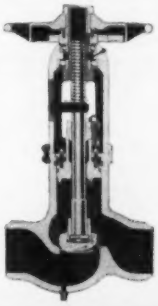
For high pressure—high temperature service, integral valve seats pay for themselves a dozen times over. So, Edward makes them standard construction in the higher temperature ranges, optional for moderate temperature service, and has them available in globe, angle, gate, non-return, instrument and other valve types in a full size range. Integral seats are leakproof seats. There are no threads to corrode—no points for erosion to start—no welds on seat rings to fail. An integral seat valve in a clean piping system needs no maintenance—no replacement.

*For sizes, types and ratings write for Edward catalog 104.*

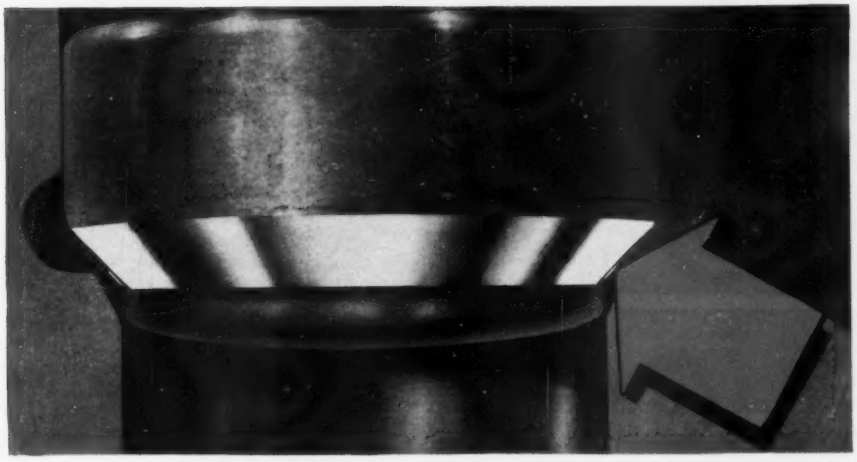
EDWARD—"BIRTHPLACE OF BETTER VALVE DESIGNS"

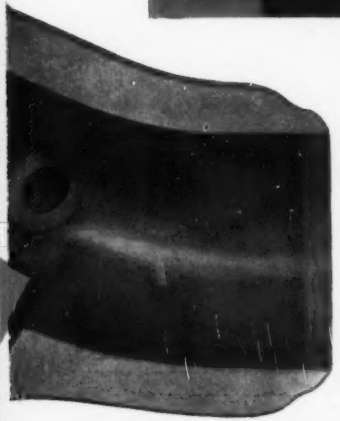
# In a Full Range of Valve Sizes

Specify Edward valves with integral, hard-surfaced seats across the board, for Edward and only Edward gives you this permanently tight, leak-proof feature in every steel valve size from ½ in. to 16 in.



**See how the Edward integral seat is part and parcel of the valve body itself. Stellite is applied by weld deposit on the machined valve body seat area. The entire body is then heat treated to remove stresses and prevent distortion. Next, the seat is machined to mirror-smooth finish and exactly mated to the hard faced disk.**





**FEATURES LIKE THIS SAVE YOU TIME, TROUBLE AND MONEY...**

*IT PAYS TO SPECIFY EDWARD VALVES*

*WITH AN INTEGRAL SEAT THERE ARE* ***NO LEAKS*** *BETWEEN SEAT AND BODY*

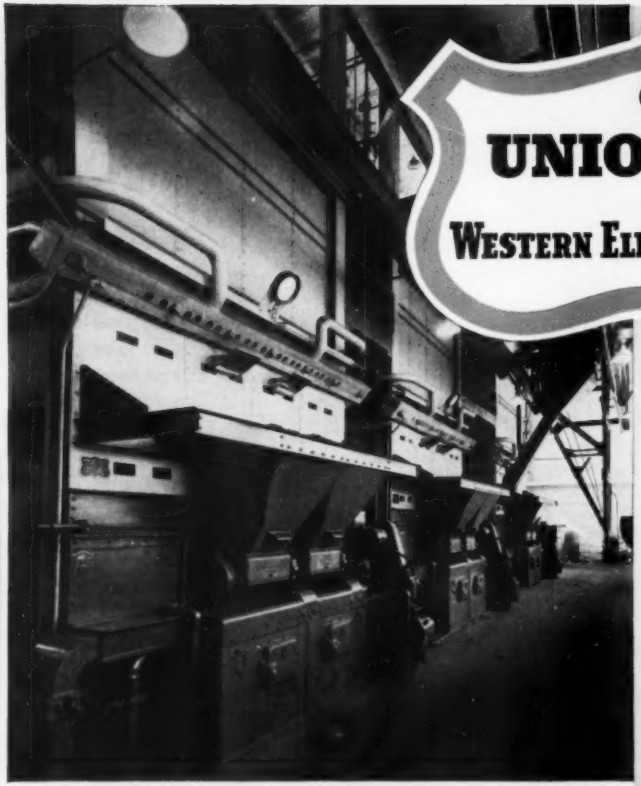
Another Product

## Edward Valves, Inc.

Subsidiary of ROCKWELL MANUFACTURING COMPANY

EAST CHICAGO, INDIANA

# 3 UNION BOILERS AT WESTERN ELECTRIC INDIANAPOLIS



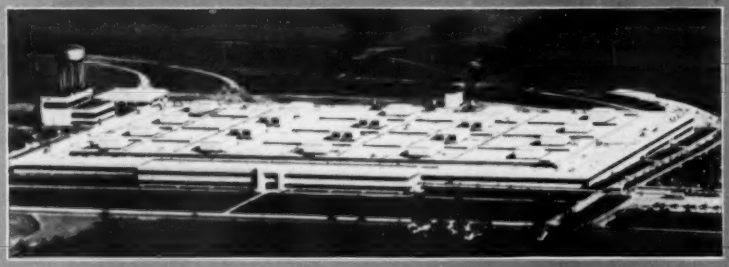
3 Union "VO" Type 60,000 lb. per hr. Steam Generators equipped with Detroit C.A.D. Spreader Stokers.

## THE WORLD'S LARGEST TELEPHONE SET PLANT *installs* 3 UNION BOILERS

The new Indianapolis plant of Western Electric Company Inc., began operations on November 15, 1950. It will meet the Bell System's increasing volume requirements and exacting demands for manufacture of telephone instruments.

The new Indianapolis plant will be the Bell System's primary source of telephone sets.

Union Steam Generating units are products of over a half century's experience in meeting requirements such as those of this great new Western Electric Plant. Their ability todeliver satisfactory service is recorded in repeat Union installations where expansion requires additional steam generating equipment. Your boiler requirements entrusted to our engineers are in capable hands.



**UNION IRON WORKS . . . *Since 1890***

373 CASCADE STREET • ERIE, PENNA.

**BOILERS • PROCESS EQUIPMENT • FABRICATED STEEL**

**FRED ANNETT** at the desk he leaves August 1, after 35 years as senior associate editor of POWER

***Farmer, lumberjack, sawmill hand, railroader . . .***

***teacher, practical electrician, engineer, and . . .***

***one of America's outstanding technical editors***

# *That's . . .* THE ANNETT STORY

► BACK IN 1888, a nine-year-old Canadian lad got his first job, picking up potatoes at 25¢ a day. There was only one hitch. The farmer wanted him only in the afternoons, when the potatoes had dried. Earning 12½¢ a day wasn't enough, so the boy quit after three days, collected 37¢ and got himself another job where he could work a full day.

The lad was Fred A Annett, known to POWER readers the world over, now retiring as senior associate editor. In 63 years of "full" days since that first job, the initiative, energy and self-reliance revealed then made him, among other things:

1. Holder of a record for board feet of spruce sawed out in a day on a single-cut bandsaw.
2. Master teacher of practical electricity and electronics.
3. Acknowledged authority on hydroelectric power, pumping, elevators, mechanical power transmission.
4. Author of five highly successful books for practical engineers.
5. POWER staffer for 35 years, "dean" of technical editors.

**Looking back** over the long trail from the farm through lumber camps and railroad gangs to the work he loves—teaching and that special kind of teaching that is engineering journalism at its best—Fred likes to tell of the friendly help and guidance he got along the way. But the fact is that, more than most men, Fred made his own way. Nothing was handed to him, nothing came easy. And he wouldn't have wanted it any different. All he's ever asked is the chance to grasp the opportunities of a free man in a free land. How he grasped them is a story that, even to us who know it well, has a touch of the miraculous.

**Farm Couldn't Hold Him.** Fred Annett was born near Woodstock, New Brunswick, Canada, but grew up in the village of Lakeville. The only career that rural area offered a youngster was farming. After his potato-picking start, Fred did various farm chores for about four years. But the farm couldn't hold him.

It was a time when many young men went to the "States"—to work the forests, mines and railroads of a young and lusty country in its

**IN WOODS GANG** at turn of the century, Annett reveals clue to what his future will be—only reading matter in sight is in Fred's hands. In those days, he worked winters as a lumberjack and summers as a top sawmill hand

great burst of expansion. Tales of those who returned to the village fired Fred's imagination and he soon headed for the lumber camps of New Brunswick and Maine.

**A Record Falls.** The summer of 1900 found Fred a setter, riding the carriage in a sawmill at Farmingdale, Maine. With a sawyer having the prophetic name of McGraw, Fred set a new record—153,000 board feet in 10 hr. This same sawyer, quite inadvertently, set Fred's feet on the path to New York and a publishing career under another McGraw.

The next winter, Annett started for Mobile but stopped off at Georgetown, S. C., where his fellow record holder was working out the winter months. Before he knew it, Fred was again a setter, helping McGraw cut lumber in a big way. Just one and a half days of it convinced him his sawmill days were over, and he headed North.

**On the Railroad.** Somewhere along the way, the young Annett got the idea that railroading was what he wanted. With a total capital of $2.75, no job, no place to live, and no friends, he landed in the Pennsylvania RR station in Jersey City. In an hour he had a line on a job and was settled in a boardinghouse; by the following morning he was a switchman in the Pennsy yards.

Although he stuck at it five years, as switchman and later brakeman, Fred soon knew that railroading wasn't the mysterious something he was seeking. And he also knew that to get what he wanted he must have more than village-school education.

**The Hard Way.** Fred began by buying an arithmetic. Then he remembered the village schoolteacher had mentioned something called "algebra." That led to plane geometry. Life settled into a grinding routine: three hours a day in bed, the rest divided between the job and study. Looking back now, Fred says that study was really his job and railroading his recreation.

When he'd gone as far as he could on his own, Fred turned to correspondence courses, then enrolled in an electrical school in New York. He was still earning a living, still at it "round the clock".

**School Days.** Long hours didn't bother Annett, but the fact the school wasn't doing all it could did bother him. There followed a sort of one-man revolution, which had these effects: The school was enlarged, the courses improved, and the students got what they paid for. Out of the shuffle Fred emerged as instructor in electrical machinery, with a whole floor full of all kinds of equipment that had never been put to use. He gave up railroading, concentrated on putting that equipment to work in a real course in electrical machinery.

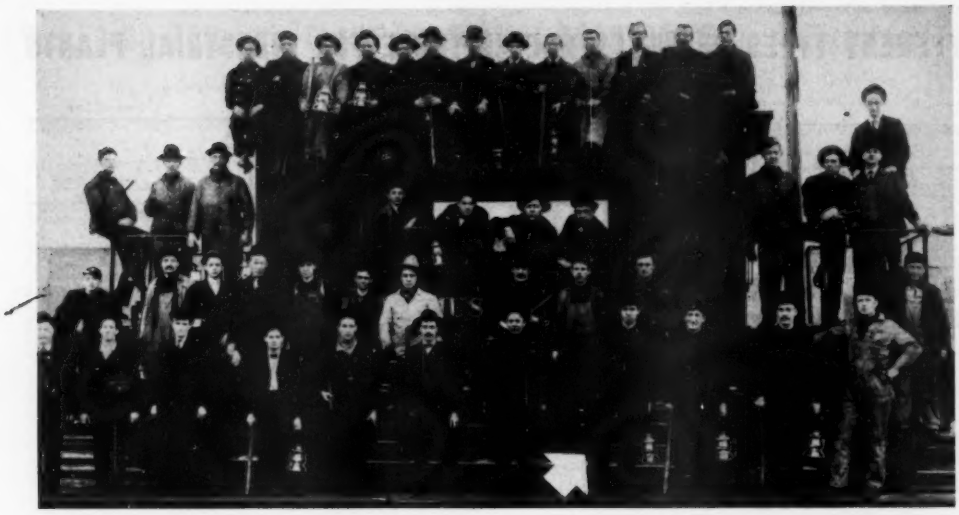
Two and a half years of this educational work—and, typical of Fred, plenty of after-hours study—brought a desire to test his growing know-how. So he got himself a job, working weekends without pay for a company doing general electrical contracting and maintenance. They soon liked their no-pay weekender well enough to hire him full time.

**Looking for Trouble.** Fred soon found himself chief trouble shooter. His tales of tough problems he licked always command an audience when the POWER gang sits around yarning in the pause at the end of the day. One deals with a hotel where a motor bearing burned out one night.

Ever resourceful, Fred ripped the copper lining from an old toilet flush box, wrapped strips around the shaft. Not best practice, chuckles Fred, but it kept the motor turning until a new bearing could be fitted.

**Into Publishing.** Many an old-time editor got his start in the print shop. It was the classical route to journalistic eminence—printer's devil to editor. Fred Annett came into publishing through the printing plant, but he's probably the only editor who began by handling electrical maintenance.

It was in his trouble-shooting days that Fred saw his first copy of POWER. He saw it in the plant of the Hill Publishing Co. which came under his wing in his job with the maintenance firm. When, a few years later, he returned to the electrical school as chief instructor, he remem-



**WORKING ON THE RAILROAD** was once his recreation, says Fred. His real job was after-hours study—first on his own, then at an electrical school. If he slept more than three hours a day, he figured he was wasting his time

bered POWER, decided it would be good for his students.

**Subscription "Salesman."** Fred went after the circulation manager. "How about reduced rates for students?" he asked. None were available, but the circulation manager knew a go-getter when he saw one. On the spot he made Fred a subscription salesman, to be paid 50¢ for each new subscriber and no questions asked. POWER then sold for $2.00 per year. With Fred foregoing his 50¢ commission, his students got the magazine for $1.50.

Came a day when the circulation manager introduced Fred to one of the editors, who was puzzling over a subscriber's question. The gist of it was, "How do you operate a transformer at a frequency other than the one for which it was designed?" Fred came up with some practical angles and was asked to put them into an article. From that moment Fred was caught, caught in work that never ceased to fascinate him.

**First Blood.** Fired with an urge to write more, a lesser man might have beaten a path back to the friendly editor, looking for further assignments. Not Fred. He took a long and thorough look at literature available for the practical electrical man. There were many gaps, but one of the biggest was the subject of induction motors. Here was a good place to start and Fred never asked for more. Before he was finished, he'd put together eight articles, and power engineers had the answers they'd been seeking.

Other practical articles followed. After four years as an increasingly valued contributor, he was offered the post of associate editor on the POWER staff, then headed by the great Fred R Low. Annett says now that it was something he'd wished for from the first time he met Low and became familiar with the magazine, but never expected to attain.

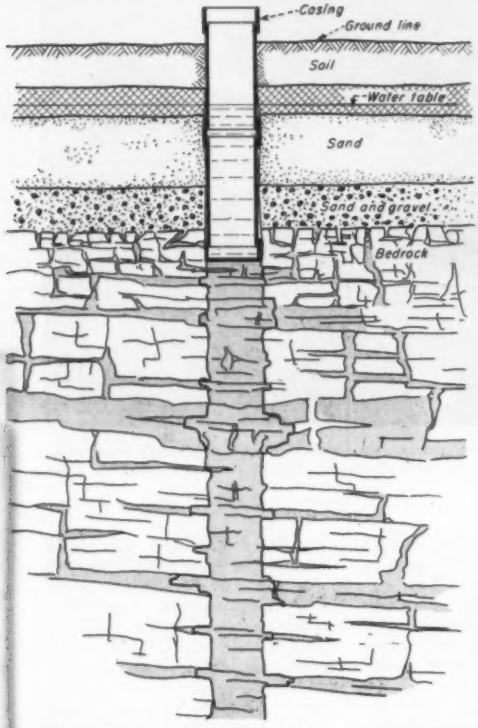
**An Editor Is Made.** On May 1, 1916, when Fred Annett began his long association with POWER, an editor was made, and a book was born. Fred soon saw the need for really practical information on electrical machinery. As an instructor, he had developed a course and teaching methods he knew were sound. With typical Annett energy, he put his ideas to work. The Jan 15, 1917 issue carried the first lesson in the now-famous "Electrical Study Course." It was an immediate success and Fred was encouraged to put it into book form. Under the title *Electrical Machinery*, it's gone through three editions.

**Old Problem, New Answer.** As a trouble-shooter, Fred had always gone beyond finding what was wrong and fixing it. He wanted to know "why." To show readers what happened inside dc machines when a fault occurred, he developed a method of drawing armature windings laid out flat yet looking as they did in the machine. Here was a pioneering step in technical illustration in the long POWER tradition of excellence in this important art. The articles in which the new scheme was first used, combined with material on reconnecting dc machines by A C Roe, formed the basis for Fred's second book, *Connecting and Testing Direct-Current Machines*, published under joint authorship in 1925.

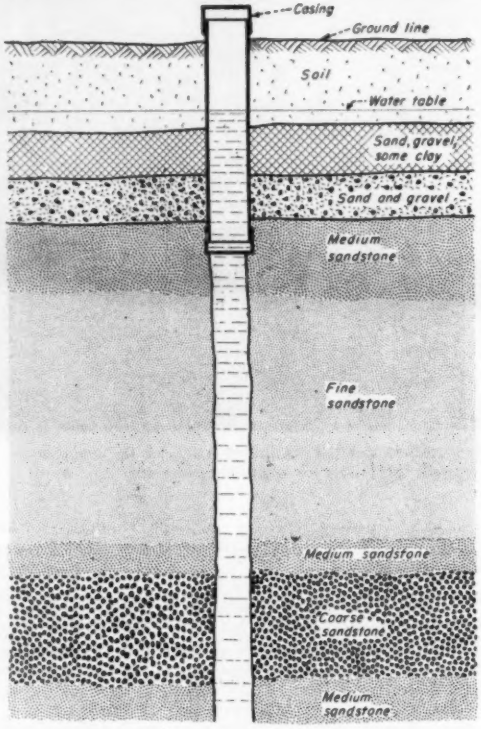
**Filling Needs.** This pattern of finding a need and filling it thoroughly, appears again and again in Fred's editorial career. Yet it's never been a matter of slavish repetition. Always he's approached a familiar field from a new direction—as in his articles and books on "Electrical Elevators" and "Pumps"—or tackled an entirely new field—as in his enormously popular special section on electronics and the series, "Electronics for the Power Engineer." He began the latter (soon to appear as a book) at 68—to keep himself young and useful, he says.

**Another Beginning.** Fred's going to keep right on being young and useful. He's only leaving his desk and the tyranny of deadlines. Already, he's bursting with ideas for articles he's going to write and plans for the next of his world-renowned tabulations of hydroelectric installations. We're glad he'll continue to be a member of the POWER family and know you, too, will be glad.

## DIFFERENT TYPES OF WELLS ARE SUITABLE FOR INDUSTRIAL PLANTS




**1** **ROCK HOLE** in broken limestone is cased with wrought-iron or steel pipe driven through soil, clay, sand layers




**2** **SANDSTONE WELLS** often produce usable quantities of water for industrial plants. Yield depends on stone porosity

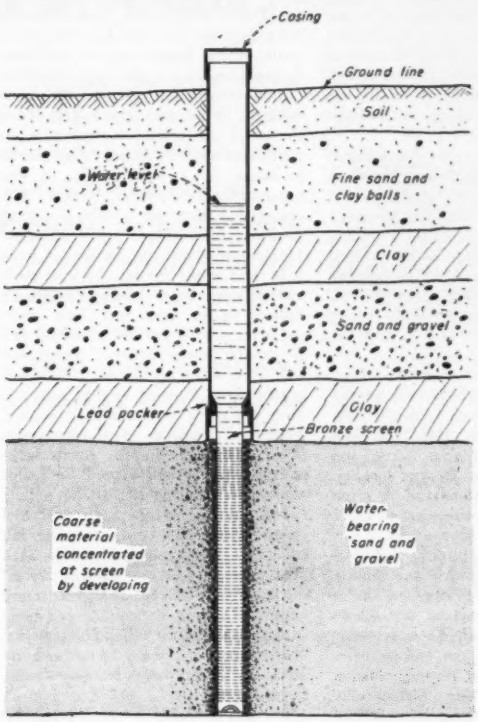
### *For Low-Cost, Dependable Water . . .*

# Choose Industrial Wells Carefully

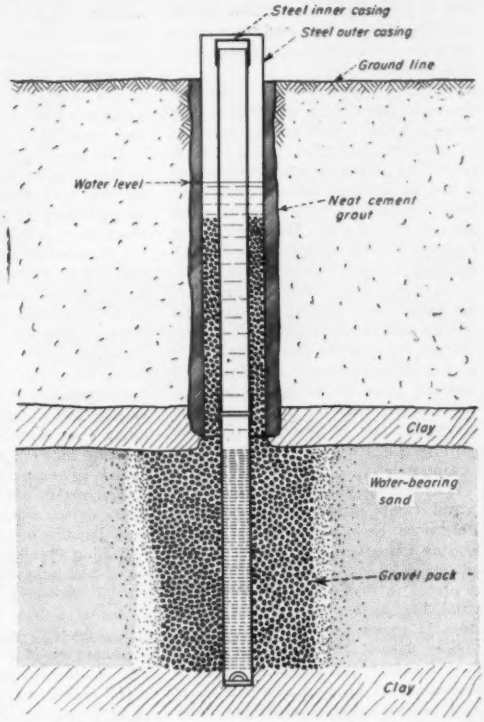
By **JOHN B MURPHY**, *Senior Service Engineer, American Water Works Service Co, Inc*

**More and more industrial plants are becoming major users of underground water. Unwise practices, drought and pollution create area shortages, lead to regulation, restriction. Here are basic facts to help select the right well for your plant**

# WELLS DO RUN DRY; RIGHT SELECTION, CONSTRUCTION ARE IMPORTANT




**3** **DEVELOPED WELL** has coarse material concentrated at screen to permit free water flow without excessive fines




**4** **GRADED GRAVEL** is used in this under-reamed gravel-packed well to reduce flow velocity around screen at entrance

► WATER-BEARING FORMATIONS, suitable for construction of wells of greater capacity than household types, fall into three rough classes: (1) rock having many cracks or fissures, usually limestone (2) sandstone (3) sand or gravel deposits, or both. The last may have several subdivisions like glacial deposits, prehistoric river beds or ancient sea beds. Glacial and river beds may be related.

**Limestone Formations.** Most wells in Indiana, Ohio and Pennsylvania are "rock holes" in broken limestone. They are cased with wrought-iron or steel pipe driven through upper layers of soil, clay and sand. Pipe is driven one to six feet into bedrock. From there on well is an open hole, Fig. 1.

Yield of a rock hole depends on many variables. Basic one is amount of water fed entire well-field area. Others are general permeability of limestone aquifer, well diameter, and number of water-bearing cracks and fissures intercepted by hole. Cracks and fissures may be irregular in size and location. They have much influence on value of the well. Of two wells with the same diameter and depth, separated by a distance of only a few hundred feet, one may yield 200 gpm, the other 50 gpm.

Water from rock holes may be hard, with many dissolved minerals and gases like iron, manganese, $CO_2$ and hydrogen sulfide in solution. It may be highly corrosive and objectionable for use. Gases are removed by aeration (spraying the water in air or allowing it to splash over coke trays). Iron oxidizes and can be removed by sand filters. Iron and manganese are fixed in solution by lime and ferric chloride, ferric sulfate or zeolites. Since this is a complex job you get best results by consulting water-treatment specialists.

Removal of gas from water is important because it may vapor-bind centrifugal or turbine well pumps. Unit then acts like a centrifuge, separating water and gas. Water passages are restricted by gas, flow is reduced, or stopped intermittently, or altogether. Take a look at any turbine-well-pump manufacturer's guarantee. It says, in effect, "performance is based on pump handling clean water free of entrained gas or air."

**Sandstone Wells.** Sandstone is sand grains cemented together by some mineral. It may be porous and hold much water. If sand grains are uniform in size and shape, and coarse enough so spaces between are large, it may yield water in usable quantities. With fine grains plenty of water may be present but capillary action or surface tension can prevent flow of usable amounts.

There are, however, many satisfactory sandstone wells, Fig. 2. In Iowa we "shot" a 2190-ft-deep sandstone well with nitroglycerine at 1400 ft and at the bottom. Static water level is six feet below ground, yielding about 1200 gpm

# A GOOD WATER SUPPLY IS AN ASSET FOR EVERY INDUSTRIAL PLANT

with a pumping level of about 150 ft. Shooting shatters the sandstone, creating large cavities that expose more area to yield water.

**Wells in Sand, Gravel.** Sand and gravel formations are very satisfactory water producers. They present problems in formation hydraulics similar to sandstone. The perfect situation compares to a bed of marbles all the same size, large or small. Size doesn't affect amount of water the bed can contain, but does influence rate of flow through bed and its ability to yield water.

Going back to our marble illustration, the larger the spheres, the less total surface exposed to cause friction and the less tortuous the flow path. Now if we mix different sizes of marbles, small ones fill some of the spaces between larger ones, reducing room available for water, rate of flow and yield. So uniformity of size is desirable in formation material.

Construction of wells in sand and gravel differs widely from rock holes. Hole must be cased to top of water-bearing formation. A screen to prevent entry of sand but allow passage of water is placed in formation. Formation material, Fig. 3, is a mixture of different sizes. If screen selected prevents passage of fines it will also restrict water flow. Properly chosen screen allows a percentage of fines to pass but holds back coarser material. Fines enter well until they are exhausted from a large enough radius around screen. Flow velocity is then so low that water won't move finest material present. Such a well is called a "developed well."

Non-movement of fines is the best argument against not pumping at highest possible rate. Many a good well is ruined by over-pumping that creates velocities sufficient to continually move fines in and plug screen. Redevelopment may or may not be possible. A developed well is built by selecting and installing a proper-sized screen and surging well by one of several means so flow reversals and high velocities are created. This washes fines into well where they are periodically removed.

Another method of reducing flow velocity around screen uses graded gravel packed at bottom of well, Fig. 4. Gravel size selected gives low velocity at pack edge without heaving and surging, and with little disturbance of natural arrangement of formation.

**Who Builds Wells.** Most important point to remember is that well building is an art, not a science. If possible select a drilling firm with an established reputation and experience in your immediate locality. This may be a nationally known firm or a home-town driller with a good record. Beware of the unknown and untried; you're betting a large sum of money on the rig operator's skill, knowledge, experience and integrity.

Ask for a performance bond equal to the value of the contract. Premium for this runs about 1% and is borne by purchaser. If the bonding company won't issue a bond for your contract, you must be doubly careful. Don't allow a driller to move in on your site unless his equipment is sound and well kept. Even if you collect on the bond it may not pay for a well site that is irretrievably lost.

Don't be "oversold" on a well. Some firms specialize in high-capacity gravel-packed wells, refusing to build anything else. Worth of this type well depends entirely on your needs and nature of formation in the locality. Under certain conditions and in given localities, we would consider no other type. But this is not always true.

**Drilling Problem.** Here's a practical example of how you may be oversold on a well. Recently we had test holes drilled at a New England site where glacial deposits prevail. Water demands permitted use of 500 gpm, and no more. The drilling company recommended a gravel-packed well giving a high specific capacity (gallons of water delivered per foot of lowering of the pumping water level in well). Price was $6000. This seemed rather high and a bid on a developed well was requested. Price was $3600, but we were assured we couldn't obtain a specific capacity equal to that of a gravel-packed well.

Test samples and data showed that a developed well was best for our gpm requirements. It was built and gave 800 gpm with a 13-foot drawdown, or a specific capacity of $800/13 = 61.5$. At 500 gpm, drawdown would be only 7 to 8 feet.

Suppose the specific capacity could have been doubled by a gravel-packed well. Drawdown would be halved but pumping head for 500 gpm would be only about 1.5 psi less. This is negligible compared to $2400 difference in cost.

**Well Pointers.** Wells should be reasonably plumb, free from kinks and "dog legs." Many are surprised to find that a well is almost never perfectly straight and plumb. Drilling tools tend to offset or slope away from formation irregularities. This may be overcome to some extent, depending on conditions.

Don't be stingy with well diameter. Manufacturers size turbine well pumps 6, 8, 10, 12 in., and larger. This is not the exact pump size; instead it is the particular manufacturer's size for installation in a well casing of that nominal *inside* diameter. With a 12-in. casing and 10-in. pump there is enough clearance to move pump to compensate for drift or other irregularities in borehole. And an air line for checking static and running water levels is easily installed. In an open rock hole, some water may enter well above pump bowl. If annular space between pump and well bore is too small, water flow will be restricted, causing loss in capacity. You will also have false pumping-water-level readings. Our experience shows that money spent for a large enough hole is well repaid by better performance during life of the well.

Instruments for checking well and pump performance are extremely important. You are completely in the dark unless you have accurate means of finding water level in well, measuring pump output in gallons per minute and pressure or head against which pump works. Measurement of these items and no others, is the minimum to assure satisfactory operation.

It's also desirable to check pump input horsepower, amperage at motor terminals and motor rpm. With these additional items you can conduct complete field tests of both pump and well. Made periodically and recorded, such tests indicate pump wear in advance. You can plot a continuous record of water levels in the well to obtain a clue to the behavior of the water-bearing formation in general and also the well itself. Specific capacity of a well doesn't depend on nor is it affected by pump performance. It is only a measure of well performance. A well good for 400 gpm that is tested at 300 gpm will have about the same specific capacity at both rates.

If the static water level drops off materially from a general lowering of the water table in your area, you can expect well specific capacity to fall off, too. Without appreciable change in static levels and a lowering of specific capacity you have well trouble and must cure it fast.

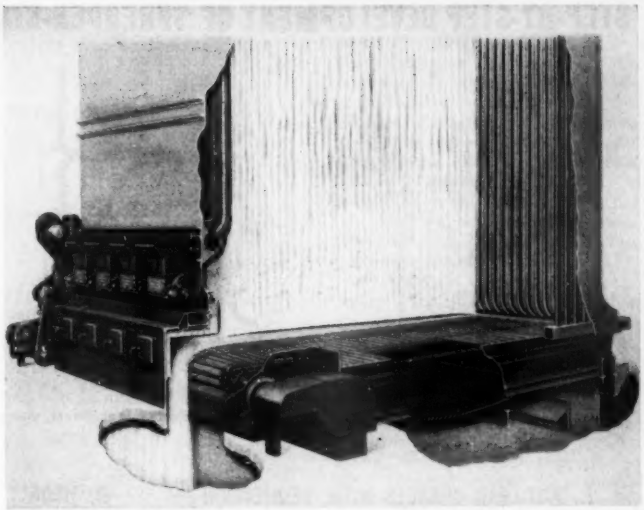
**NOW TURN TO P 120 FOR PRACTICAL DOPE, SKETCHES AND PHOTOS ON WELL CARE, PUMP MAINTENANCE**

## FURNACE DUST FLOWS IN SET PATTERNS...

**Simplest flow sees coarser dust drop out in first boiler pass, with bulk of stack cleaning left to dust collector**

**▶ Partial reinjection feeds some dust back to the spreader-stoker grate, salvages heating value from waste**

**Total reinjection increases dust loading; collector must be more efficient**



**Spreader-stoker firing** results in 33% of the ash leaving the furnace as flue dust, so controls over the dust paths are one way to reduced stack discharge

# Spreader Dust Responds to Controls

By ELMER R KAISER, *Asst Director of Research, Bituminous Coal Research, Inc*

STACK-DUST CONTROL for spreader stokers requires: (1) good design (2) good operation (3) external aids in the form of dust collectors. With each requirement playing its proper part the spreader stoker can easily meet the usual limits of dust emission set by local air-pollution ordinances.

In practice, particularly with units already operating, these three control factors may fall short of the ideal balance. Real problems like space limitations, dollar cost of a collector installation, penalty and nuisance of dust disposal and, to some extent, possible heat recovery from unburned carbon influence purchase of dust collectors.

**Design.** Importance of furnace space in completing combustion has been recognized since the early work of Kreisinger. In fact, today it is quite generally accepted. Enough space permits establishing the favorable conditions of time, temperature, turbulence and proper available oxygen.

With older, already installed boilers, the basic conditions are often not met. Usually furnace temperature gets high enough and the proper oxygen can be made available. But often low-setting heights and otherwise inadequate combustion space limits the available time. The excellent work of Engdahl, Major[1], et al, on furnace jets has gone a long way toward correcting this weakness.

They found locating jets about 12 in. above the fuel bed, and in some instances lower, gives particularly good results. For conditions requiring turbulence over the full grate of a stoker, jet nozzles in opposite walls spaced about 24 in. apart meet the bill. More details on jet design and location can be had from other sources.

**Reinjected Dust.** But there is still another control factor that effectively lengthens available combustion time and also reduces stack-dust loading. That is a system of dust or cinder reinjection employing dust collectors.

A plant actually can do one of three things: (1) Trap and collect all possible dust, and dump as refuse. (2) Reinject all cinders removed in boiler passes for refiring, and dump all dust at the collector stage. (3) Return all collected dust to the furnace and have only fine ash to dispose of. Since we are concerned with increasing available combustion time as well as controlling stack-dust loading, we'll consider only the last two—partial or complete reinjection. Here are influencing elements.

**Overfire Jets.** The basic furnace and dust-reinjection system shows in Fig. 1. By rearranging the piping from boiler pass A and dust collector B to the furnace proper, the amount of dust reinjected can be changed from partial to total. Overfire air jets are included because they are essential to good operation with reinjected dust. But their actual location and number can be varied for best results.

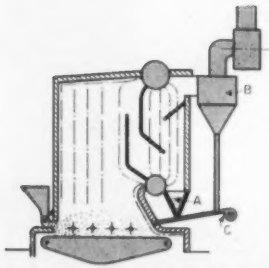
**Dust Return.** Reinjected dust must enter the furnace so it can land on the fuel bed. If not, all particles will be lifted right out of the combustion chamber in short order. Fine dust in particle form sticks to the fuel bed in one of two ways: either by being wedged or held in place under or between larger pieces of ash or by lying adjacent to larger pieces away from high air and gas-stream-velocity paths.

In the high-temperature zone near the top of the fuel bed fine ash particles tend to sinter or fuse into heavier pieces that remain on the bed.

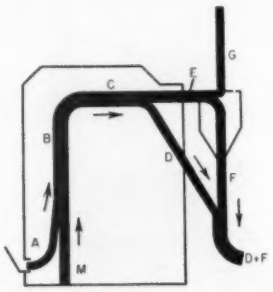
A series of tests with 1¼ by 0 in.

(1) R B Engdahl, W S Major, Technical Report VI. Bituminous Coal Research Inc, 3600 First National Bank Bldg, Pittsburgh 22, Pa.

# STEP-BY-STEP DEVELOPMENT OF SPREADER-STOKER DUST PATHS SHOWS

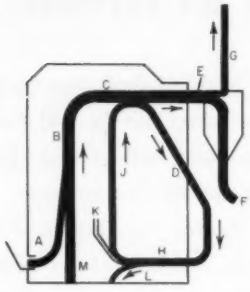



**1** Simplified furnace shows last pass hopper, dust collector, reinjection




(a) Without refiring

**2** With no reinjection at all dust path follows straightforward course above




(b) Partial refiring

**3** Partial reinjection complicates dust paths but promises some advantages

## I: DUST-LOAD CHANGES WITH REINJECTION

| | Without refiring, % | Partial refiring, % | Total refiring, % |
|---|---|---|---|
| Required efficiency of dust collector | 70 | 74 | 90 |
| Efficiency of boiler-pass hopper | 30 | 29 | 25 |
| Ash content, stack dust | 60 | 65 | 80 |
| Ash content, collector dust | 45 | 48 | 65 |
| Ash content of dust from boiler-pass hopper | 33 | 34 | 45 |

## II: HOURLY BOILER DUST WITHOUT REFIRING

| | Total Pounds | Pounds Ash | Pounds Combustible | Percent Ash | Percent Combustible |
|---|---|---|---|---|---|
| G given | 67 | 40 | 27 | 60 | 40 |
| F = G × 0.70/0.30 | 156 | 70 | 86 | 45 | 55 |
| E = F + G | 223 | 110 | 113 | 49 | 51 |
| C = E/(1.00—0.30) | 318 | 141 | 177 | 44 | 56 |
| D = C—E | 95 | 31 | 64 | 33 | 67 |
| A given | 125 | 25 | 100 | 20 | 80 |
| M = C—A | 193 | 116 | 77 | 60 | 40 |
| B = C | 318 | 141 | 177 | 44 | 56 |
| D + F | 251 | 101 | 150 | 40 | 60 |

## III: HOURLY SUMMARY OF DUST

| | | Without refiring | Partial refiring | Total refiring |
|---|---|---|---|---|
| Dust: | refired, lb | 0 | 92 | 826 |
| | lost to stack, lb | 67 | 67 | 67 |
| | lost to refuse, lb | 251 | 190 | 0 |
| | lost, total, lb | 318 | 257 | 67 |
| | percent of coal fired | 6.4 | 5.1 | 1.3 |
| Ash: | refired, lb | 0 | 31 | 493 |
| | lost to stack, lb | 40 | 43 | 54 |
| | lost to refuse, lb | 101 | 91 | 0 |
| | lost, total, lb | 141 | 134 | 54 |
| | refired, left on grate, lb | - | 7 | 87 |
| Carbon: | refired, lb | 0 | 61 | 333 |
| | lost to stack, lb | 27 | 24 | 13 |
| | lost to refuse, lb | 150 | 99 | 0 |
| | lost, total, lb | 177 | 123 | 13 |
| | refired and burned, lb | - | 54 | 164 |
| | Carbon loss, % total Btu in coal | 4.0 | 2.7 | 0.3 |
| | Steam gained, lb | - | 500 | 1510 |

**What's the dust loading in lb per 1000 lb of flue gas?**

**How much ash is refired?**

**What's the percentage of carbon that's recovered?**

**These tables supply the answers**

coal on a spreader-fired locomotive had 80% of the cinder carryover caught in a collector. By reinjecting into the firebox at a low level about half the cinders burned on refiring. Most of the cinders left their ash behind on the fuel bed as large pieces. About 43% of the ash in the original cinder was recovered in this way with a firing rate of 45-50 lbs per sq ft per hr.

**Coal Size.** Primary cinder, *A*, Fig. 1, goes way down in quantity with a double-screened coal. It can double or triple with a ⅜ by 0 in. coal. Doubling the primary dust increases dust loading about 25 lb per hr. To effectively remove this added load from the gas stream the collector has to increase its efficiency 18-23%. Yet the price advantage between the double-screened coal and the smaller coal is such that it may well be worth the extra trouble.

A second and less desirable way of meeting the problem is to continuously withdraw to refuse a fraction of the collector catch. Wasting 50 lb an hr or one eighth the catch of a single collector removes the extra 25 lb of ash an hr.

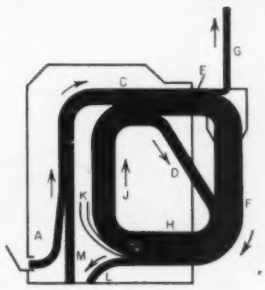
Still another possibility would be two dust collectors in series. Dust in the second collector would run at least 80% ash and could be dumped to refuse. Many plants use mechanical dust collectors followed by electrostatic.

**Firing Rate.** Once firing rate gets above 20 lb per hr per sq ft, each increase after that raises the dust loss from the furnace. More primary cinder and flyash result because more coal is fired. It's as simple as that.

In addition the higher air rate through grate and furnace entrain larger and heavier particles.

Without reinjection, rate of dust emission above half load increases by about the 1.4 power of the firing rate.[2] Increasing the excess air through the grate raises flow rates and shortens available combustion time for particles in the furnace. Flow rates through the fuel bed that cause the particles to

# HOW STACK LOADING PROBLEMS GROW




(c) Total refiring

**4** Total refiring increases loadings to the limit of collector efficiency

## PATH IDENTIFICATION

- **A** Primary cinder
- **B** Total new dust
- **C** Total furnace dust
- **D** Catch of boiler-pass hopper
- **E** Dust to collector
- **F** Collector catch
- **G** Stack dust
- **H** Refired dust
- **J** Recirculating dust
- **K** Refired combustible burned
- **L** Refired ash to grate
- **M** Dust loss from grate

### IV: HOURLY BOILER DUST WITH TOTAL REFIRING

| | Total Pounds | Pounds Ash | Pounds Combustible | Percent Ash | Percent Combustible |
|---|---|---|---|---|---|
| G given | 67 | 54 | 13 | 80 | 20 |
| F = G × 0.90/0.10 | 603 | 392 | 211 | 65 | 35 |
| E = G + F | 670 | 446 | 224 | 67 | 33 |
| D = E × 0.25/0.75 | 223 | 101 | 122 | 45 | 55 |
| H = F + D | 826 | 493 | 333 | 60 | 40 |
| C = E + D | 893 | 547 | 346 | 61 | 39 |
| A from Table II | 125 | 25 | 100 | 20 | 80 |
| M from Table II | 193 | 116 | 77 | 60 | 40 |
| B from Table II | 318 | 141 | 177 | 44 | 56 |
| J = C − B | 575 | 406 | 169 | 71 | 29 |
| K + L = H − J | 251 | 87 | 164 | 35 | 65 |
| L = 0.44 B − 0.80 G | 87 | 87 | — | 100 | — |
| K = H − J − L | 164 | — | 164 | — | 100 |
| C = B + J | 893 | 547 | 346 | — | — |

L/0.60 H = 18% ash recovery on grate

K/0.40 H = 49% carbon recovery

### V: HOURLY BOILER DUST WITH PARTIAL REFIRING

| | Total Pounds | Pounds Ash | Pounds Combustible | Percent Ash | Percent Combustible |
|---|---|---|---|---|---|
| G given | 67 | 43 | 24 | 65 | 35 |
| F = G × 0.74/0.26 | 190 | 91 | 99 | 48 | 52 |
| E = G + F | 257 | 134 | 123 | 52 | 48 |
| D = E × 0.29/0.81 | 92 | 31 | 61 | 34 | 66 |
| H = D | 92 | 31 | 61 | 34 | 66 |
| C = E + D | 349 | 165 | 184 | 47 | 53 |
| A from Table II | 125 | 25 | 100 | 20 | 80 |
| M from Table II | 193 | 116 | 77 | 60 | 40 |
| B from Table II | 318 | 141 | 177 | 44 | 55 |
| L = 0.44 B − 0.65 G − 0.48 F | 7 | 7 | — | 100 | — |
| J = C − B | 31 | 24 | 7 | 77 | 23 |
| K = H − L − J | 54 | — | 54 | — | 100 |

L/0.34 H = 23% ash recovery on grate

K/0.66 H = 88% carbon recovery

move and teeter in the fuel bed increase dust losses because very little if any smaller ash particles can be trapped in the bed itself.

**Dust Paths.** The simplest dust-flow pattern with spreader stokers employing a dust collector shows in Fig. 2. In this case with no reinjection, *A* and *M* are the only dusts entering the boiler passes. The coarser dust, *D*, drops into the boiler pass to reduce dust loading at the collector, *E*. Here a portion of the finer ash dust escapes to the stack but most stays behind.

With partial reinjection, Fig. 3, some dust, *D*, reenters the lower part of the furnace a short distance above the fuel bed. With this dust projected at an angle toward the grate some of it, *L*, stays on the grate and some of the combustible, *K*, burns out of the cinders on either the grate or in the furnace space. Whatever doesn't burn or stay on the grate, *J*, leaves again with the the furnace gases.

Total reinjection, Fig. 4, produces heavier dust loadings than any other method. Only a minor fraction of reinjected ash deposits on the grate. And only a part of the returning cinder burns in each cycle. Finally at a given firing rate, dust loading reaches a point of equilibrium. A dust collector of higher efficiency is needed to hold stack-dust load below nuisance limits. There is, however, an upper limit of collector efficiency so the dust loading has to stay within that range to avoid offending the usual smoke ordinance.

**Expected Results.** From a study of design factors and published data the probable weights of dust passing through the boiler can be figured for the three methods shown in Fig. 2-4. For comparison purposes a 45,000-lb-per-hr spreader stoker, firing coal at a constant rate of 5000 lb per hr, serves as the guinea pig. Its stack-dust loading must stay below 0.85 lb per 1000 lb of flue gas, corrected to 50% excess air to meet the most stringent smoke ordinances.

Coal for the boiler is 13,200 Btu, 1¼ by 0 in. size, 10% ash content with 5% minus 20-mesh particles. Gas velocities at a firing rate of 40 lb per sq ft per hr (total 5000 lb per hr) can entrain these particles of minus 20 mesh. All that these particles lose in the furnace is moisture, most volatile, a minor amount of fixed carbon. Because of this we assume the particles lose half their weight on their first flight so the remaining bit has an ash content from 10 to 20%.

All heavier coal pieces burn on the grate. Some flyash and carbon leave in the gas stream in an assumed ratio of 60% ash to 40 % carbon.

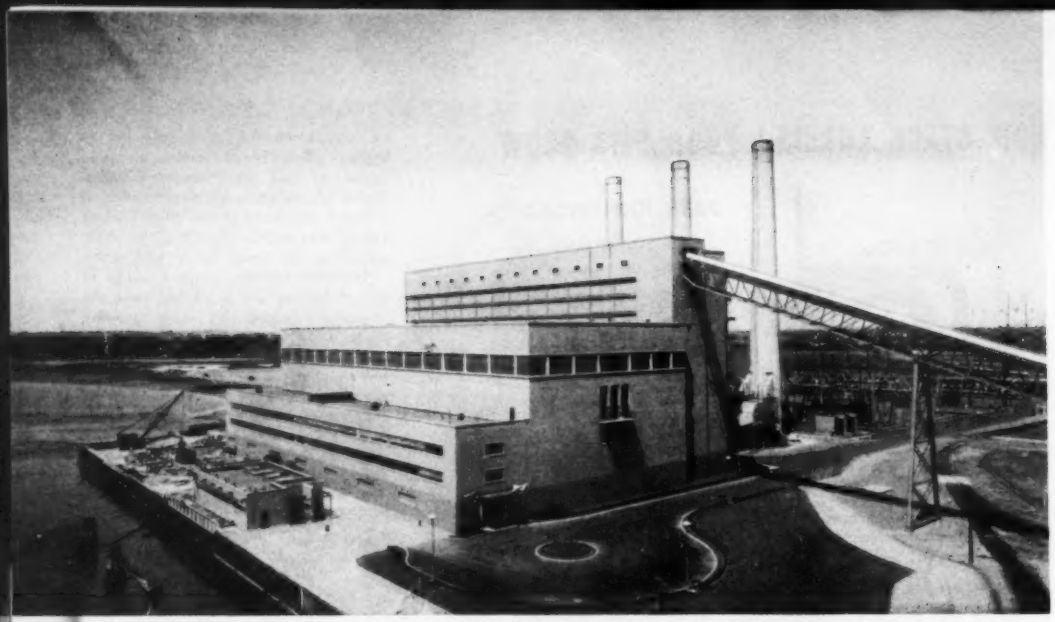
At 35% excess air, 66,100 lb per hr of air flows through the furnace. Jets supply 5% of this excess over the fire. For calculation purposes the total gas becomes 78,500 lb per hr at 50% excess air (12% $CO_2$). For legal dust emission. maximum allowable dust by weight is 67 lb per hr.

Now let's see what effect reinjection has on stack-dust loading. We know with reinjection a more efficient dust collector must be used. Further, the boiler-pass hopper removes fewer cinders as proportion of finer dust from reinjection increases. Table I lists the changes in the principal factors we have to deal with in comparing performance. The collector efficiency shown is an over-all measure for the size consist and class of dust entering the collector.

**Dust Flows.** For our example boiler, the loadings of each section of the different dust paths have been calculated. Tables II, IV, V. In addition, the proportions of refired ash, *L* and combustibles, *K*, not reappearing, are worked out at the bottom of Tables IV, V. Ash and combustible quantities plus their individual percentages make up the rest of the data shown.

This article is based on "Dust Emission From Coal-Fired Boiler Furnaces," presented before the Midwest Power Conference, Chicago, Ill., April 1951, and the Air Pollution and Smoke Prevention Association of America, Roanoke, Va., May 1951.

(2) E. M. Powell, Flyash From Stokers, *Combustion*, Vol 21, pp 39-41, Nov 1949.



**SEWAREN STATION** of the Public Service Electric and Gas Co put every effort into reducing boiler feedwater makeup to the lowest point. They even draw the steam for fuel oil and building heating from special evaporators described below

**Surface-water quality can vary all over the lot and be different from day to day. Just how to give it automatic treatment and keep chemicals regenerated, also automatically, posed a problem in . . .**

# Preparing Water for Evaporator Feed

**By R I SMITH**
*Public Service Electric and Gas Co*
**and J R DENTON**
*Worthington Pump & Machinery Corp*

► IN DESIGNING the Sewaren Generating Station of Public Service Electric and Gas Co, *photo above*, every effort went into reducing boiler feedwater makeup to the lowest possible point (POWER, August 1949, pp 98-102). All steam auxiliaries, for example, were eliminated. Evaporators, *top of facing page*, were picked to provide steam for fuel oil and building heating needs. Whatever makeup water the four 950,000-lb-per-hour, 1700-psig, 1050-F steam generators required was to come from these 30,000-lb-per-hr evaporators. City water, however, served as feed supply for these evaporators. This supply, Table I on p 83, varied considerably in character since its origin was and is the surface reservoirs and wells of the Middlesex Water Co.

**Treatment Needed.** Water treatment was necessary to produce an evaporator vapor of optimum purity. So the ion-exchange system, which indicated the most reasonable possibilities, was investigated from several aspects. Because of the relatively high silica content, deionization was studied but did not seem justified. The hydrogen-zeolite system, followed by aeration to remove free $CO_2$, and corrective caustic feed for pH control appeared most practical. Further, the second step in deionization and silica absorption could be added if operating results showed it necessary.

Supplementary treatment of sodium sulfite, caustic soda, and phosphoric acid directly injected to the boiler feedwater system, completes the treatment for the station. Main boiler feedwater deaeration takes place in the condenser hotwells.

The city-water treatment equipment for evaporator makeup had to meet the following specifications:

1. Completely automatic, except that remote manual initiation of the regeneration cycle in response to an alarm is acceptable. (Water treatment plant is an entirely separate building to the rear of the station.)

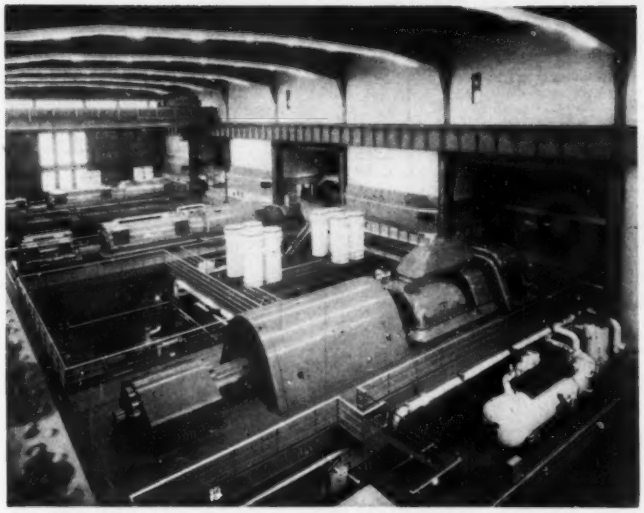
2. Two exchange units are supplied, each designed for regeneration every 12 hours with a continuous flow of 30,000 lb per hr (60 gpm) of water having a total cation content of 15 gr per gal (256.5 ppm).

3. Further, exchanger design is such that, with one unit out of service, the other can produce 60,000 lb per hr (120 gpm) of treated water with a flow rate not greater than 8 gal per sq ft per min through the tank.

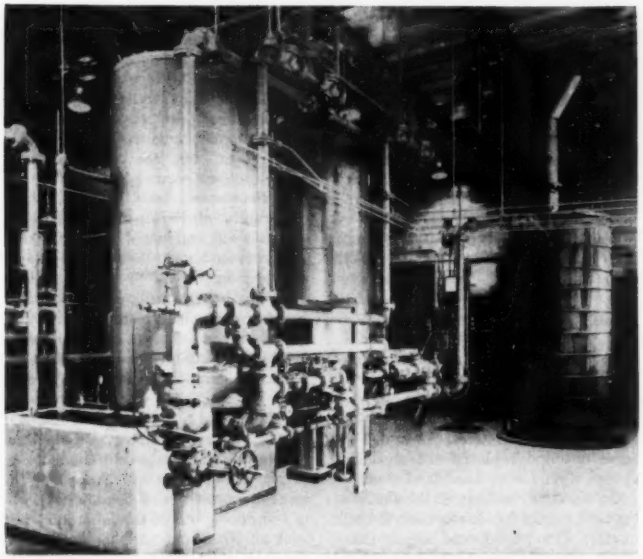
4. A forced-draft aerator, having 90,000-lb-per-hr (180-gpm) capacity.

5. The pH control point is 6.5, but equipment is designed to operate with a pH control set to any point in the range from 5 to 8.5.

6. Automatic regeneration equipment



**EVAPORATORS,** 30,000-lb-per-hr capacity each, mount on platforms next to each of the first three turbines. A steam jet deaerator stands alongside each evaporator



**ACID-ION** phenolic-resin exchange units have pneumatic-operating valves regulating flow through the units with control centering at the aerator storage-tank level

feeds required acid from a concentrated-acid storage tank to exchangers with no acid handling except that needed to maintain an acid supply in the concentrated-acid storage tank.

7. Over-all performance that gives: (a) A total hardness of water leaving the aerator not over 3 ppm. (b) A free $CO_2$ leaving the aerator not over 5 ppm. (c) A pH of treated water after adding caustic soda averaging not more than plus or minus 0.2 of a pH unit from the set pH control point.

**Equipment Operation.** Flow diagram on p 82 shows the schematic arrangement of the evaporator's entire feedwater-treatment system. City water enters the system through a pressure reducing valve, which maintains constant pressure at the exchanger inlets.

In service operation the exchange units run in the conventional manner with a phenolic resin as the exchange medium. All main operating valves are pneumatic, with flow through the units controlled from the aerator storage-tank level. Aerated water receives its caustic-soda injection in a built-in mixing chamber, equipped with mechanical agitator, while passing from aerator to storage tank. Three evaporator feed pumps take the water from this tank and pump it into the evaporator feed header.

The caustic-soda solution feeds to the mixing chamber through a control valve (operated by a pH recorder controller) from a small constant head tank supplied from an 800-gal dilute caustic tank. The dilute solution (normally 10%) is made up by taking liquid caustic soda (50%) from an overhead 3000-gal storage tank and adding the required amount of water.

**Regeneration.** To simplify controls, the exchangers are regenerated and rinsed upflow. A single float-operated valve, ahead of an orifice plate in the waste pump, controls backwash, regenerant and rinse water.

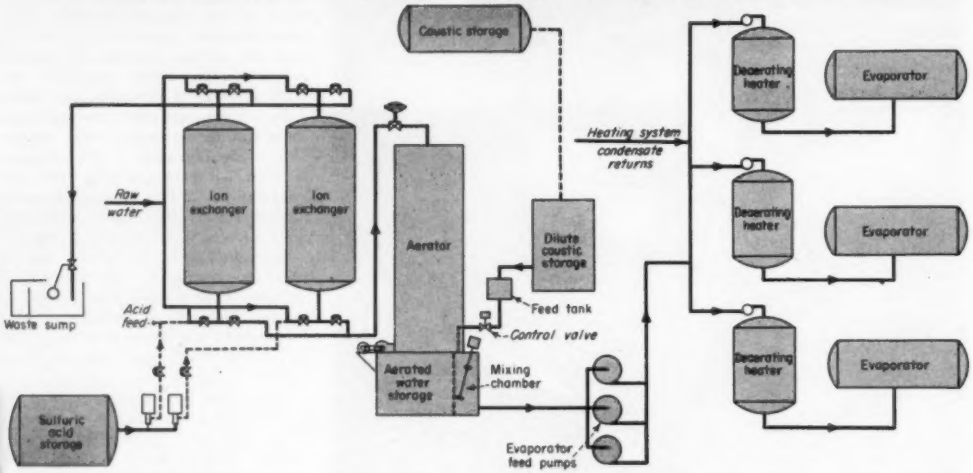
During the acid feed portion of the cycle, concentrated sulfuric acid (66 deg Be) pumps into the normal backwash line to be diluted to about 2% acid. Adjustable-stroke reciprocating pumps take the strong acid directly from a 3000-gal storage tank.

**Automatic Control.** An outstanding feature of the treatment system is the way the completely automatic control is accomplished. Heart of the automatic system, a regeneration controller, paces the unit control valves and acid pump through the necessary sequence of the regeneration cycle.

Originally, the regeneration cycle was started manually in the station control room for No. 1 and 2 units in response to an alarm from a water-flow counter. This counter, on the control panel in the chemical-treatment building, received impulses from an integrating-type flowmeter and rang an alarm when a predetermined number of impulses had been received. But with a variable and unpredictable raw-water quality, Table I, regeneration on the basis of total flow proved inefficient because the automatic equipment must be set up for the maximum cation content expected.

We recognized this fact at the outset, and designed equipment to eliminate

## HYDROGEN ZEOLITE SYSTEM FOLLOWED BY AERATION HAS AUTOMATIC pH CONTROL




**CITY WATER** enters the external water-treatment equipment through pressure-reducing valve, put in to maintain constant pressure at the exchanger unit inlets, and leaves with a pH of 6.5, total hardness close to zero, free $CO_2$ under 5 ppm

the influence of variations in water quality. For experimental purposes we put in equipment to regenerate a unit at exhaustion on the basis of conductivity. Subsequent operation has shown that this experiment works and the regeneration cycle now starts automatically by an impulse received from a conductivity meter.

All controls for the system, with the exception of alarms and the original regeneration control switches, are on a panel in the chemical treatment building. These instruments include flowmeters, flow counters, pH recorder-controller, regeneration controllers, conductivity meter, pressure gages, chemical-storage-tank-level indicators, and electrical switches for the entire treatment plant. All switches normally stay in the automatic position, but regeneration can be manually controlled if necessary.

Regeneration controller of the two units interlock so only one unit may be regenerated at a time. Indicating lights in the station control room show when a unit is being regenerated. The 4-point conductivity meter connects to cells in the raw-water inlet, the outlet of each exchanger, and the outlet of the treated-water storage tank. System trouble alarms connecting to the pH and conductivity recorders are in the main control room.

**Operation and Maintenance.** City-water treatment system went into service in October 1948, to supply water for boiling out, acid cleaning and preliminary operation of the boilers of No. 1 and 2 units. Since that time, the system has been operating to supply treated water for evaporator feed. Reliability of the equipment is good so little maintenance has been required.

Several changes to correct obvious shortcomings were made after the equipment was installed. Variations in city-water pressure and water pressures higher than control-air pressure, used to close the direct-acting diaphragm valves, made it necessary to install a pressure-reducing valve at the raw-water inlet. The acid-pump discharge piping originally installed with a rubber-lined valve at the point where it discharged into the zeolite-tank inlet piping, had the rubber diaphragm of this valve, as well as the steel piping behind it, fail in service because of corrosive action of the acid. We pulled the valve out and replaced the steel discharge piping with lead-lined steel.

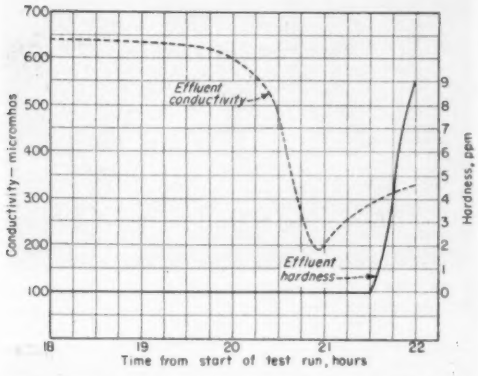
On occasion, leakage at the shafts of the acid pumps has made them difficult to start. This trouble was largely eliminated through proper adjustment of the packing and use of an acid-resistant lubricant. Strong acid damaged two of the rubber-lined diaphragm valves at the tank inlets during the initial operation of the system, so new valves were installed. A stainless-steel air-vent valve and a small section of lead-lined acid feed piping, which may have been defective, failed in service and had to be replaced. Except these few cases, only routine maintenance of the equipment and controls has been required.

The system operates with a minimum of attendance. A routine inspection of the equipment takes place once a day and the caustic solution is made up once a week. An operator normally checks the chemical-treatment building every hour, but the water-treatment system seldom requires attention.

**Performance Tests.** The Testing Laboratory of Public Service Electric and Gas Co. conducted a series of five performance tests of the water-treatment system from Feb 27 to March 3, 1950. During all these tests, the effluent had zero hardness until the unit approached exhaustion and the run was considered finished when the hardness reached 3.0 ppm, the guaranteed maximum. Conductivity of the effluent was measured during these tests to support data obtained by the station operating personnel on the relationship between conductivity and unit exhaustion. Measurements of effluent hardness and conductivity, obtained during one of the laboratory test runs on No. 2 unit, are plotted in diagram on p 83. These curves cover the last four hours of the test run and are representative of all tests conducted.

Effluent conductivity which was at the level of 600-700 micromhos dropped to less than 200 micromhos about an hour before any increase in effluent hardness was detected. No tests were made for sodium, but it is evident that conductivity accurately detects breakthrough of sodium ions. Rapid decrease in effluent conductivity as the exhaus-

## AUTOMATIC REGENERATION DEPENDS ON CONDUCTIVITY READINGS




**TEST RUNS** supported the belief that the exchanger units could be reactivated on the bases of the conductivity alone

### I: Sewaren City-Water Analyses, Middlesex Water Co

Aug 1946 to Feb 1947

| | PPM | | |
|---|---|---|---|
| | Min | Avg | Max |
| Suspended matter | 0 | 4 | 10 |
| Total dissolved solids | 169 | 235 | 279 |
| Organic and volatile matter | 12 | 44 | 100 |
| Silica ($SiO_2$) | 2 | 11 | 20 |
| Chloride (Cl) | 0 | 9 | 14 |
| Sulfate ($SO_4$) | 50 | 83 | 134 |
| Bicarbonates ($HCO_3$) | 24 | 92 | 160 |
| Iron and aluminum oxides | 0 | 1 | 3 |
| Calcium | 33 | 50 | 69 |
| Magnesium | 4 | 11 | 19 |
| Sodium | 0 | 4 | 9 |
| Ammonia | 0.01 | 0.32 | 1.90 |
| Free $CO_2$ | 9 | 26 | 49 |
| Total hardness ($CaCO_3$) | 113 | 168 | 226 |
| pH | 6.92 | 7.26 | 7.85 |

### II: Test of City-Water Treatment, Sewaren Gen Station

Feb 28 to Mar 1, 1950

| | | RUN NO. 2 |
|---|---|---|
| Duration of run | - hr | 21.50 |
| Total flow | - lb | 491,000 |
| Average flow | - lb per hr | 22,837 |
| Average cations in raw water | - gr per gal as $CaCO_3$ | 11.89 |
| Total cations absorbed | - grains as $CaCO_3$ | 700,426 |
| Guaranteed absorption | - grains as $CaCO_3$ | 647,715 |
| Total absorption | - % of guarantee | 108.14 |
| Average $CO_2$ at aerator outlet | - ppm | 1.80 |
| Treated water pH - maximum | | 10.25 |
| minimum | | 4.90 |
| average | | 6.92 |
| RAW CITY WATER ANALYSIS: | | |
| Total hardness - ppm as $CaCO_3$ | | |
| maximum | | 175 |
| minimum | | 150 |
| average | | 162 |
| Conductivity - micromhos | | |
| maximum | | 418 |
| minimum | | 305 |
| average | | 382 |
| pH - maximum | | 8.88 |
| minimum | | 6.90 |
| average | | 7.62 |

tion point is reached makes regeneration on the basis of conductivity entirely feasible.

Other results of the same test run on No. 2 unit, summarized in Table II, show the unit to be meeting its requirements for exchange capacity and carbon-dioxide removal as well as effluent hardness. But pH of the treated water was not maintained within the limits of 0.2 of a pH unit. Average pH during the run, 6.92, was close to the set control point of 6.5, but variations from this point were excessive.

Analyses of raw city water made during the test show a total hardness variation of 25 ppm, from 150 to 175 ppm, and conductivity values from 305 to 418 micromhos. City-water pH varied from 8.88 to 6.90 and averaged 7.26 during the test.

**Operating Results.** Quality of the evaporator vapor indicates the effectiveness of the evaporator feedwater treatment. A test of No. 3 evaporator at Sewaren, conducted May 3, 1950, showed that evaporator vapor, having an average measured conductivity of 0.853 micromhos and an average corrected conductivity of 0.505 micromhos (0.5 ppm $CO_2$) in the vapor, was obtained when evaporating 28,300 lb per hr with a total dissolved solids concentration of 507 ppm in the shell. The apparent coefficient of heat transfer during this test was 811 Btu per hr per sq ft per deg F where the specified heat transfer rate was 588 Btu per hr per sq ft per deg F, which gives an indication of the degree of tube cleanliness.

As previously mentioned, raw water at Sewaren, and consequently the evaporator feedwater, runs high in silica. During the evaporator test in which the shell's total dissolved solids concentration was 507 ppm, the soluble silica concentration was 50.8 ppm. Boilers operate with drum pressures of about 1700 psig where any concentration of silica in the boiler water will tend to carry over into the turbine. So every effort is made to maintain the silica concentration in the boiler water as low as possible.

A final measure of the effectiveness of the evaporator treatment system in contributing to the production of high-quality makeup water is the silica concentration, which can be maintained in the boiler water. During the 6-month period from March 1 to August 31, 1950, the silica concentration in the boiler water of the three boilers has averaged 0.85 ppm.

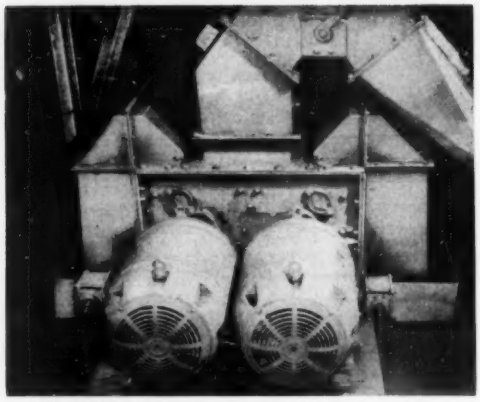
A variety of materials was used in constructing the system. Exchange vessels and piping carrying acid water are all steel, rubber-lined. Diaphragm-control valves are rubber-lined and the flow-control valve at the aerator inlet is stainless steel. All caustic-soda storing and handling equipment is steel or cast iron. The sulfuric acid-storage tank and the piping from the tank to the acid pumps are steel. Acid pumps are cast iron and the discharge piping and valves from the pumps to the zeolite-tank inlets are lead-lined steel. The aerator and the treated-water storage tank are wooden. Evaporator feed piping from the treated water-storage tank to the evaporator deaerators is red brass. Evaporator feed pumps are bronze and the evaporator deaerator elements, vent condenser tubes and tube sheets are stainless steel.

**Summary.** A satisfactory evaporator feedwater is obtained by treating raw water in a cation-exchange system, operating on the hydrogen cycle with upflow regeneration and pH control by the addition of caustic soda. An evaporator vapor of high quality can be produced from this water. The nonscaling character of the treated water results in low evaporator maintenance. The completely automatic features of the treatment system accomplish the desired objective of reducing the required attendance to a minimum.

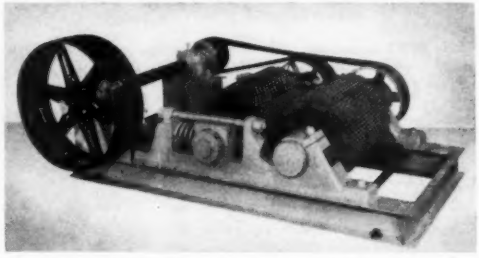
# Pick the Right Coal Crusher for Better Firing

**Improve stoker and pulverizer performance in your plant by putting the right crusher on the job. Use approved selection methods for best results. This article, the second of two, gives 11 questions and answers to help you pick a crusher, tells what to watch for in specifying**

BY TYLER HICKS, *Assistant Editor*



**1** **DOUBLE-ROTOR** crusher has triangular sectors, crushes 63 tons per hr of damp sticky coal in paper-mill power plant



**2** **DOUBLE-ROLL** crusher has easily removed toothed segments on each roll, spring relief to protect teeth, belt drive

**1 What factors govern selection of crushers for power plants?**

Grade of coal, feed size, capacity needed, product desired and adjustability—where a range of sizes is to be made. No one type of crusher answers all requirements; much care is needed in unit selection.

**2 How does service affect capacity?**

Teeth, hammers or other parts that reduce lump size may wear in time. This tends to reduce crusher capacity and increases power input to it. So it's wise to select a crusher of generous capacity.

**3 How are crushers chosen?**

Unless you have considerable experience with crusher selection it is generally best to submit specifications to the manufacturer and allow him to recommend best unit for the plant. In this way you obtain the help of specialists and are sure of good performance on the job.

**4 What information is supplied manufacturer to help select the crusher?**

Tell manufacturer what coal you use, its source, condition (wet, dry or frozen), temperature, Hardgrove grindability, method of feeding crusher, feed size to crusher and product size desired (round or square-hole size). Also tell him percent fines in feed, if they will be removed by prescreening, crusher capacity needed in tons per hour and per day, and electrical characteristics of power supply. If possible, send him a large sample of your coal for testing in his units.

When your specifications limit product size to certain maximum dimensions, you must take crusher characteristics into consideration. Breakers and hammer mills yield lumps of given maximum size continuously because all coal passes through screen openings before discharge. But roll crushers may pass oversize lumps now and then when hard pieces cause spring release to operate or when there's a gap between teeth. So manufacturers usually guarantee that 80 to 90% of product will pass a specified ring size.

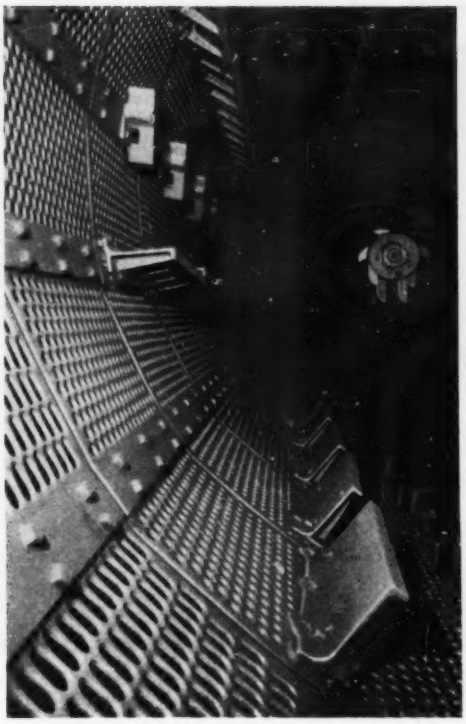
**5 Does screening out undersize coal affect crusher rating chosen?**

This depends on particular crusher you select. For example, one manufacturer recommends a crusher with a capacity 15 to 25% greater than tabulated ratings when fines up to 2 to 3 in. size are removed from run-of-mine (rom) coal, and only oversize coal is passed to crusher for reduction to sizes up to 2½ in. Others recommend that crusher capacity be found by adding tons of coal screened out and tons remaining to be crushed. Their tabulated crusher capacities are based on total tonnage ordinarily handled, large and small together. In either case, however, most manufacturers base capacities on rom coal with none of the smaller sizes removed.

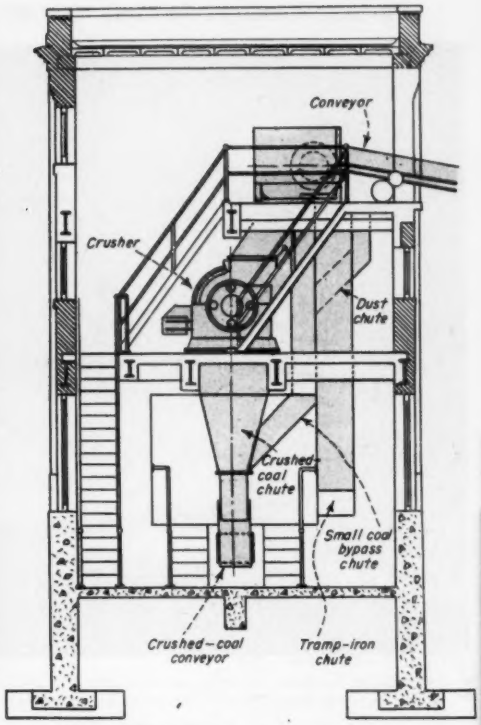
As shown in Fig. 4, you may screen undersize coal at any time during crusher operation if suitable chutes are installed. Removing undersize coal reduces power input to crusher.

**6 What are crusher power needs?**

This varies with crusher type, coal



**3** **INTERIOR** of Bradford hammer mill. It prepares 500 tons per hr. Two motors: 150 hp for breaker, 40 hp for mill




**4** **COAL-CRUSHER HOUSE** of central station has conveyor that feeds crusher; another removes crushed coal. Note chutes

hardness and size, and a number of other factors. Bradford breakers require from 0.2 to 0.3 hp per ton. Typical 2-roll crushers need about 0.50 hp per ton for hard coal, 0.25 hp per ton for soft coal. Single-roll hp-per-ton ranges from about 0.88 to 0.06 for same coals.

**7 What motor types drive crushers?**

Induction motors drive many crushers—squirrel cage for the smaller sizes, wound rotor for the larger ones.

**8 What are important considerations in crusher installation?**

Sufficient room all around and above crusher for easy servicing and maintenance is extremely important. Roll crushers and hammer mills withstand severe operating conditions and need regular care for best efficiency. Study crusher layout carefully to see that repairs can be made with minimum disturbance of connected parts.

Use heavy foundations of sufficient size for good support of the unit. Be sure all connections to crusher are dust tight and supported so they can't vibrate. Vent to a high point crusher discharges that can't be made tight. Gravity or forced ventilation may be used.

**9 What two limits do you work between in crusher operation?**

Upper limit is proper percentage of coarse coal needed for the pulverizer or stoker. Lower is the percentage of "fines" (coal that passes through a 200-mesh screen). These limits vary with crusher application.

**10 Can moisture affect operation?**

Generally you'll have little trouble from moisture in coal. When small sizes are handled in rainy seasons you may run into some trouble from jamming in chutes. Steeply sloped chutes of ample area do much to prevent clogging. In some installations stainless-steel chutes may be advisable but in most plants plain steel does fine job.

**11 What are good feed sizes for pulverizers and stokers?**

Here are a few that have been found satisfactory. Of course they are by no means fixed for all jobs you run into.

With pulverizers, closely sized coal, ½x¼ in., allows water to drain easily, flows freely and can be fed uniformly. Single-retort stokers shouldn't be fed lumps larger than 1¼ in. if the coal has a hard, mechanical structure. Multiple-retort stokers operate well on crushed coal from 2 in. to slack. Not more than 50% of slack should pass through a ¼-in. screen.

Maximum screening size for coal fed spreader stokers should be ¾-in. Then carbon loss in ashpit refuse will be low. But these units burn fuel ranging from slack to 1¼ to 1½ in. nut and slack.

Chain and traveling-grate stokers use 1¼, 1½ or 2 in. round-hole screened lumps on natural draft. With forced draft, maximum size should be ¾ or 1 in.

In addition to the manufacturers credited in the July issue, p 75, POWER *is also indebted to the following consulting engineers for assistance: Burns & McDonnell Engrg Co, Burns & Roe, Inc, Sargent & Lundy.*

**LOW-COST BOUNDARY LIGHTING CAN BE HAD BY INSTALLING WOOD POLES ON 150-FT...**

**1** Pendent-type luminaire, mounted on wood pole with overhead open wiring, forms the basic plan for boundary lighting. Typical luminaire has universal bracket that allows setting 20- to 30-deg tilt, directing light toward would-be prowlers

# You Can Tighten Plant Security With

**A well-engineered lighting plan snaps-up plant output, gives protection against thievery and sabotage. Boundary lighting, spotlighting and floodlighting all fit into the general plan**

By J S LINDSAY
*Lighting and Rectifier Divisions, General Electric Co*

► HAPHAZARD PLACEMENT of lights—and that holds for indoor and outdoor lighting—results in inadequate lighting and a hodgepodge of fixtures. This can be avoided by smart planning; here's how.

**Planning.** During preliminary survey of lighting needs, co-ordinate skills of a lighting engineer, plant-distribution engineer, plant-security officer, and guard force. Get a detailed plan of the plant. Review it with the desired type of lighting (protective, loading platform, etc) in mind.

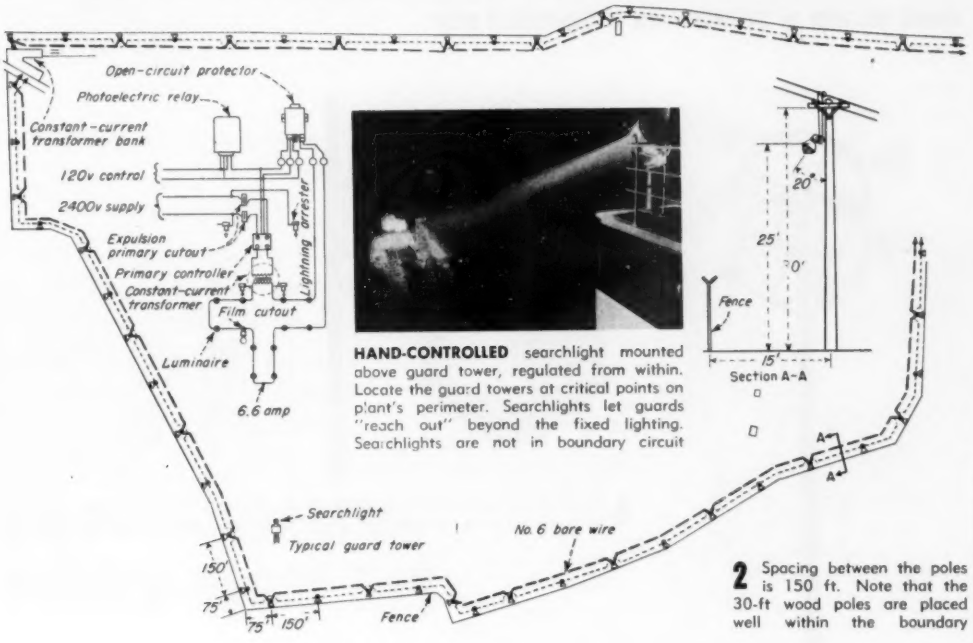
Your distribution engineer can tell what power sources are available and what circuits can be used. Plant-security officer can outline the critical areas. Plant guards should point out vulnerable areas and suggest where better light would help in tightening security.

Then make a day and night inspection of yard areas. Take these trips with a plant guard. Mark up a map of the area to be lighted with obstructions, available mountings, and existing lighting equipment. These steps are necessary before complete lighting system can be designed.

Lighting engineer can then take this preliminary information and establish the lighting levels needed for each area. And he'll recommend the most effective lighting equipment to secure these levels.

**Boundary Lighting.** Protective lighting for boundaries and fences should be one of the first projects of defense industries or power plants. Lighting boundaries discourages unauthorized entry. It provides a wall of light that reveals trespassers if they try to sneak into the property. Protective lighting for generating stations and substations is a must today.

One proven method of lighting boundaries is to use a pendent-type luminaire (fixture), Fig. 3. Mount one every 150-ft along the fence line. This unit directs light up and down the fence line creating a continuous band of light around the boundary, Fig. 1. A typical luminaire in this family has a




**HAND-CONTROLLED** searchlight mounted above guard tower, regulated from within. Locate the guard towers at critical points on plant's perimeter. Searchlights let guards "reach out" beyond the fixed lighting. Searchlights are not in boundary circuit

**2** Spacing between the poles is 150 ft. Note that the 30-ft wood poles are placed well within the boundary

# Planned Outdoor Lighting... Here's How

universal bracket that allows a 20- to 30-deg tilt when mounting. This tilt-method of mounting directs the light toward the would-be prowler. A sharp light "cut-off" in the design of the luminaire means patroling guards can remain concealed in the darkness behind the units while watching the boundary area within the light band. This tilt idea is fine for boundaries near areas that are not affected by this direct light. If the fence is next to a highway or traveled river, mount each unit without any angle from the vertical.

Typical protective-lighting installation is shown in Fig. 2. Wood poles are located 12- to 15-ft from the fence line on the plant side. Luminaires are mounted about 25-ft off the ground. And if a 10,000-lumen filament lamp is used in each luminaire, you can space the units at 150-ft intervals. These or similar units give a good overlapping of light. In case of a lamp outage, a sufficient light level is maintained.

Floodlighting a fence line with units directed perpendicular to boundaries is a possible solution for critical areas. But if you want to light the entire fence line more units will be needed (compared to the luminaire discussed above).

**Power Supply.** Electric power supplied to your protective-lighting system should have centralized control. A series underground distribution is best for most installations. Series circuit, Fig. 4, is fed from a constant current transformer. This well-regulated supply means long lamp life.

Series distribution means one central control point can be used with a minimum wiring. Energizing the constant-current transformer turns on the entire system. You may be able to run a single wire around the boundary and satisfy all fence-lighting requirements.

Supplementary lighting (multiple floodlights, Fig. 5) may be controlled by a series-multiple relay. This relay responds to current in the series circuit. In turn, it controls a contactor. This contactor can control the local multiple-floodlights.

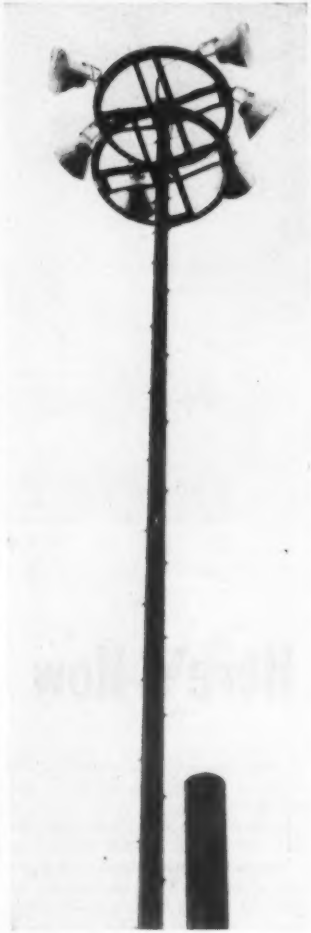
If the plant is big enough to use several series loops, cascade the systems to maintain the one central control feature. Remember lamp outages will not affect the system, because a film cutout is across each lamp. This fractures, if lamp fails, and becomes a short circuit. Hence the series-circuit continuity is maintained. This series arrangement is the same type distribution that has proven popular for street-lighting circuits.

**Internal Areas.** The guard towers at critical points and surrounding perimeter of plant are a must, Fig. 2. You can mount 18-in. searchlights on the tower, then control them from within. This lets the guards "reach" outside the fixed lighting facilities to investigate suspicious actions or meet other emergencies.

Floodlights for internal-area lighting

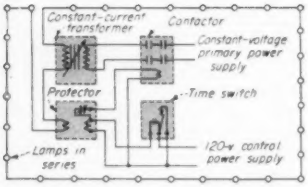
## LIGHTING COMPONENTS USED FOR FLOOD- AND BOUNDARY-LIGHTING OF TODAY'S PLANT AREAS

## SERIES METHOD OF DISTRIBUTION IS GENERALLY BEST

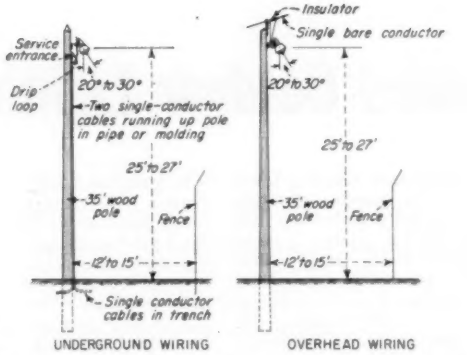


**5** Floodlights handle internal-section lighting: loading areas, entrances

**3** Pendent-type luminaire for boundary lighting; universal bracket for tilt




**4** Cutout in each unit breaks down if a lamp burns out, keeping circuit alive




**6** Although generally more costly, the series underground distribution system is best for most plant installations

—such as loading platforms, parking lots, and entrances—add to the plant's security. And they also increase the efficiency of materials handling. Objects are quickly and accurately identified when you have good lighting. Floodlighting from a central tower is economical and mighty effective, Fig. 5.

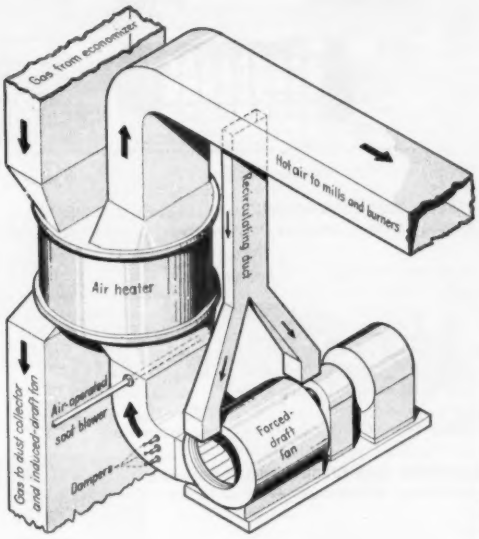
Mount enclosed-type floodlights, equipped with 1000- and 1500-watt lamps, about 50- to 75-ft above the ground. Narrow, medium- and wide-beam types are available. These will satisfy almost any lighting need. Wide-beam floodlights are fine for loading platforms or parking areas. Use narrow- or medium-beam lights for entrance "spotting" or where you want to project for large distances. This supplementary floodlighting increases safety and efficiency of night operations.

Because of the overlap of their fields of operation, it is not always apparent whether floodlights or pendent luminaires are best suited for a particular location. So your best bet is to consult reputable electrical contractors, lighting manufacturers, or lighting specialists. Do this while formulating the over-all lighting plan. Considered on a long-range basis, heat-, dust-, water-, and corrosion-resistant equipment are more economical.

# Rx Could You Cure This Headache?

▶ **All too often we learn good operating practice at cost of hard experience . . .**

▶ **That's what happened in the incident recounted here by Don Swift, Ebasco Services Inc — another in his series of troubles met and licked in starting new plants . . .**




## Case No. 3—VIBRATING FORCED-DRAFT FAN

▶ THE FORCED-DRAFT FAN serving a large pulverized-coal-fired boiler was driven by a 200-hp 1200-rpm induction motor through a hydraulic variable-speed coupling. Air from the fan passed through a regenerative-type heater leaving at about 525 F temperature. The coal burned had 3 to 5% sulfur and 10 to 15% ash.

A recirculating duct leads some heated air back to the f-d fan inlet when needed. This heated air prevents chilling of preheater plates during cold weather. If inlet-air temperature drops too low, flue-gas vapor condenses on pre-heater plates. This combines with the sulfur dioxide to form sulfuric acid, which rapidly corrodes the plates.

**Operation.** At full load, flue-gas temperature at preheater outlet was about 210 to 220 F. No troublesome deposits appeared on the preheater surface during the first few months of operation. Neither was there any corrosion. The air-operated soot blower blew from the cool end of the preheater with the stream of air. This removed deposits forming on the cold end of the preheater, moving them with the air stream, which is the usual practice.

When soot was blown we could see dust passing from the slightly open recirculating duct into the fan inlets. But no unusual deposit or fan unbalance could be noticed. After several months running during fall and early winter, the boiler was shutdown over a week-end to repair a leak.

Just when the boiler began picking up load after the usual starting cycle, the f-d fan outboard bearing began vibrating heavily. We found the hold-down stud, which clamps the bearing in the bearing shell was loose. Tightening the stud eased the vibration a little. Because we needed the unit badly, we decided to run through till the next weekend and then balance the fan.

Vibration increased with fan speed and load. Bearing clamping bolt had to be tightened several times. Then the inboard bearing pedestal began to move slightly on the foundation. Since the fan ran smoothly before the shutdown we concluded that some of the dust coating the inside of the fan blades had fallen off, unbalancing the rotor.

Finally the fan forced itself out of service. Increasing roughness broke out the grouting, letting some of the shims under the inboard bearing pedestal fall out. One of the pedestal hold-down bolts also broke off. Surprisingly, the flexible coupling between the hydraulic coupling bearing and fan inboard bearing held the rotor in place without any damage until the fan had shut down.

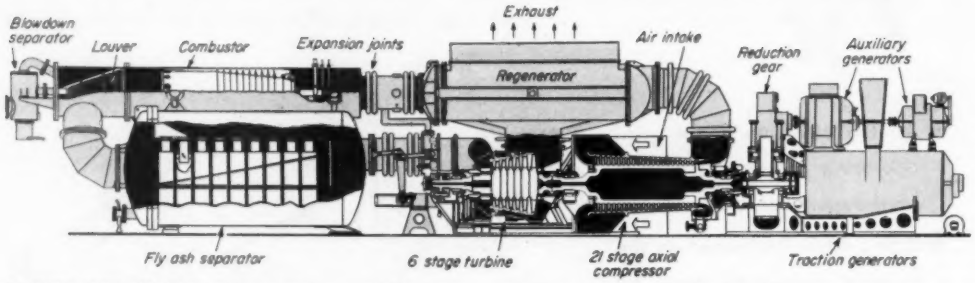
**Repairs.** Temporarily we welded a new bolt to the old one imbedded in the concrete. The fan was lined up and shims tack-welded in place without grouting. We found the inside of the fan blades coated with about 3/16 in. of fine sticky flyash, which had fallen off in several places. An air hose blew off the ash easily. The bearings and coupling had not been damaged. When the fan restarted it ran perfectly.

We used the temporary bolting about two weeks until the next outage gave time for complete checkup of fan, bearings and coupling. Everything was in good order. The old grout was carefully chipped out, and new grouting poured around pedestal and shims.

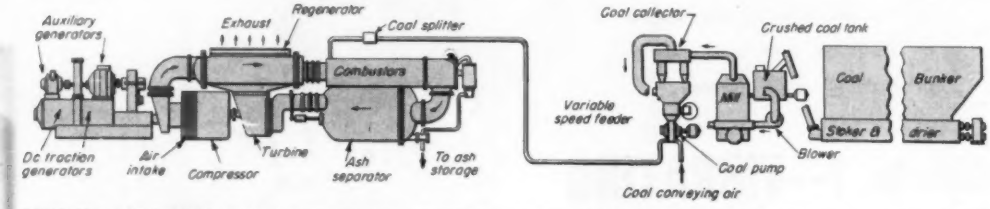
As a standard practice, the operators now clean off the fan blades at each shutdown. Air-heater exit-gas temperatures have been raised to 240-250 F by alterations. Less dust deposits on the preheater surfaces, so now less dust recirculates onto the fan blades when blowing soot.

A lower-ash coal would also help solve this problem, but the present coal is priced to make it the most desirable economically. The fan has been in good balance since this experience.

# HERE'S SETUP OF FIRST COAL-BURNING GAS-TURBINE PLANT BUILT...



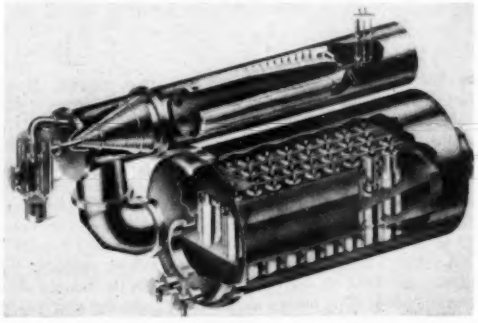

**3750-HP GAS-TURBINE UNIT** uses 21-stage axial-flow compressor, 6-stage reaction turbine, twin combustors, flyash separator, regenerator. Turbine drives compressor, two traction generators, four auxiliary generators at variable speed




**COMPLETE GAS-TURBINE PLANT** including coal preparation and storage apparatus is designed for space available in locomotive cab. The first plant will be tried out on test floor for experimental investigations before mounting on a chassis

**Development work and gas-turbine construction proceeded in parallel. Research-program delays coincided with unexpected problems in designing and building of practical power plants.**

**After successful runs on a Houdry unit with tested coal preparation and burning apparatus, Locomotive Development Committee takes next step when full-scale . . .**



**CROSS SECTION SHOWS DETAILS** of one combustor and main ash separator. These elements determine success of coal burning

# Locomotive Coal-Burning Gas Turbine

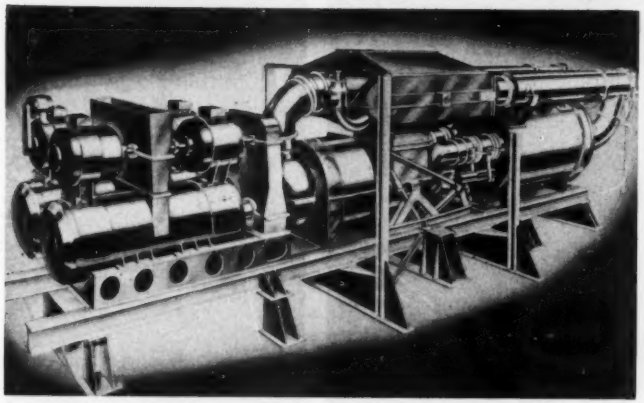
► WE REPORTED the experimental work in developing the locomotive coal-burning gas turbine in POWER, June 1951, pp 104-7. Here, in Part II (footnote, facing page) the first complete plant to go on the test floor is described.

The Allis-Chalmers 3750-hp open-cycle single-shaft gas turbine and regenerator are now being erected at Dunkirk plant of American Locomotive Co. Entire plant, see diagram above, will be arranged as if it were inside a locomotive cab. Temporary ducting will carry air from above the building's roof through a flow nozzle into compressor intake. Turbine and regenerator exhaust will also discharge through the roof.

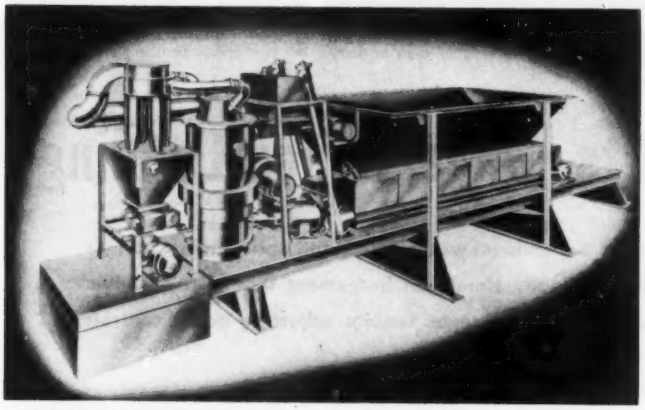
Four GE air-blown variable-resistance grids will absorb power generated by the traction generators. Plant may be run manually or automatically from the control station. Complete test instrumentation will be used.

Illustrations show coal-handling and preparation equipment now at Dunkirk. Special stoker, built by Standard Stoker Co, carries coal to rear of stoker by a 2-level screw, crushes it to 2-in. lumps by conventional breaker plates. Crushed

## ...FOR LOCOMOTIVE PRIME-MOVER SERVICE



**LENGTH OF TURBINE PLANT** conforms to conventional locomotive cab dimensions. Height limit required using two separate combustors instead of one large one, right



**COAL-PREPARATION APPARATUS** also strings out along cab length, includes bunker, stoker and drier, crusher, pulverizer, coal pump, collector, feeder, all motor driven

# Gets Ready for Testing

coal drops into two parallel ribbon-type screws moving it forward through drying section. Hot air tapped from turbine exhaust moves countercurrent to coal in these sections. Twin elevator screws lift prepared coal to storage tank between bunker and pulverizer.

A 15-hp induction motor drives the stoker through a Vickers variable-speed, reversible, hydraulic transmission. Two 175-kw alternators, driven by turbine reduction gear, supply all auxiliary power. Frequency varies from 66.6 to 40 cycles as turbine speed varies from 5700 rpm at full load to 3420 at idling. Coal delivery then varies automatically from 100% at full load to 60% at idling. Variable-speed transmission allows adjusting stoker delivery over wide range.

A Fuller level indicator in top of crushed-coal tank controls stoker operation. This starts the Vickers hydraulic motor when coal is needed. When tank level is restored it stops the motor. This keeps stoker delivery close to fuel needs, but 500-lb storage avoids needing exact regulation.

A transverse screw delivers coal from storage tank to pulverizer. The 2-speed motor drive also changes speed in proportion to turbine speed. But the mill-level controller will start and stop the motor. The 2-row Babcock & Wilcox mill delivers about 4500 lb per hr of 90% −200-mesh coal, grindability not less than 50 Hardgrove. The 50-hp induction motor drive starts and stops by pushbutton on the coal-handling electrical panel.

High-pressure casing of mill enables, if desired, trying direct firing under pressure later. Two discharge pipes carry the pulverized coal with air supplied from a 3000-cfm blower, driven by a 30-hp induction motor. Dampers regulate air flow. Coal collector strips out coal and recirculates the air back to the blower inlet. Collector has four Multiclones discharging into a small storage tank. A second level controller here operates in series with the pulverizer level controller.

An Omega Machine Co Rotolock feeder for pulverized coal is the speed control for the plant. A Hagan pneumatic positioner, run manually or automatically, actuates a speed-control lever on the hydraulic transmission through which the feeder is driven by a dc motor. Coal pump speed varies with main turbine speed.

A louver and blowdown separator, at end of each of two combustors, are of stainless steel and Inconel. Full turbine temperature of 1300 F exists from combustor outlet to turbine inlet. Tees, elbows and separator shell are Inconel X, which has excellent tensile strength up to 1400 F. Large flanges are Inconel, bolting material is 19-9 DL.

Thirty-six Dunlab tubes originally installed in the separator will be reduced by blanking off 10 to raise air flow to 1500 cfm per tube. Separator internals are stainless steel.

As soon as inevitable initial difficulties straighten out, a test of 250-500 hr will be run. This will determine effect of 1300-F air containing −10 micron ash upon the Allis-Chalmers turbine. If results are satisfactory, a series of tests simulating locomotive operation will be run.

Data for Parts I and II abstracted from paper before 1950 Midwest Power Conference. Report was made by John Yellott, director of research and Peter Broadley, asst director of research, Locomotive Development Committee, with Frederick Buckley, manager, research & development div, LDC Project, American Locomotive Co.

**1** Pilot gage board at Delray Power Plant includes lights of pressure-change indicator, which clearly show when main-line steam pressure either rises or falls

**2** Heart of pressure-change indicator is chamber standing next gas bottle

# Colored Lights Guide Boiler Loading

**Manual operation of boilers depends on watching for and anticipating changes in steam pressure and station load. Here's an instrument that clearly shows the operators when steam-pressure changes require adjusting boiler controls**

► OUR BOILER OPERATORS needed an instrument to help keep steadier steam pressure with stoker-fired units supplying a widely varying load. Three of the Detroit Edison Co's plants have manually-controlled stoker-fired steam generators.

The operators had been using the standard method of watching for pressure changes on the gage and load changes on the wattmeter. Since operators must also inspect fires and make stoker adjustments, their attention couldn't always be given to the gages. Besides, it's humanly impossible to watch instruments continuously. Even with frequent scanning it becomes difficult to spot changes immediately and make corrective adjustments. Over-regulation was the usual result.

**Specifications.** The operators wanted an instrument that would show directly whether steam pressure was rising or falling. After talking it over we drew up specifications as follows:

1. Pressure changes as low as 2 psi per min should be shown within 5 sec of the beginning of the change. When pressure change stops, the instrument should be ready to indicate the next change within 5 sec.

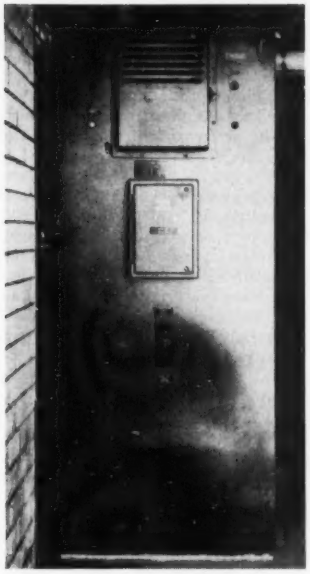
2. The instrument must show increase or decrease in pressure clearly.

3. It must be rugged and reliable for power-plant use.

We could find no commercial instrument to do the job, so we developed our own. The *pressure-change indicator* shows pressure changes of 2 psi per min in about two sec. Colored lights indicate the changes, red for decreasing and blue for increasing pressure.

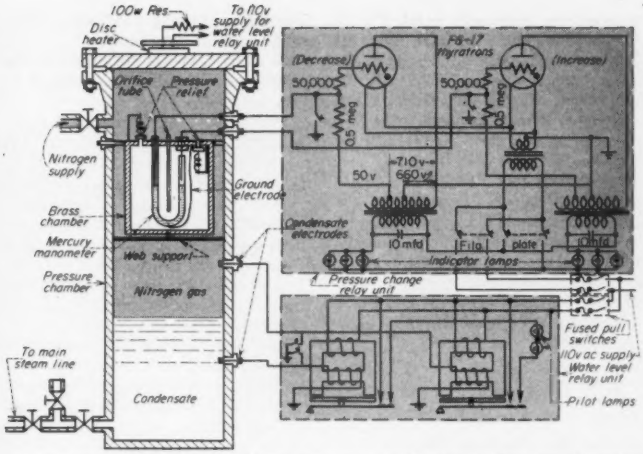
Minor short-time fluctuations in pressure, which are always present, cause random alternate flashes of red and blue lights. The operator takes action when one of the lights flashes frequently, or stays on. We felt that this simple indication was more practical than showing actual rate of change on a graduated dial.

The first model has served about seven years in the Delray plant, and the second over three years at the Conners Creek plant. They have proven reliable, needing minor attention and adjustment at about 6-month intervals. They have improved steadiness of steam pressure. Chief advantage is the greater ease with which operators can hold steam pressure. Some men feel it's an easy device to use, while others find it reduces their fatigue.

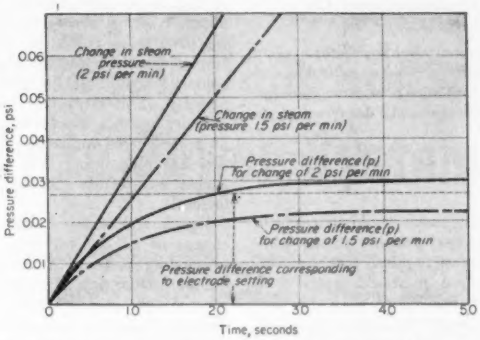


**3** Face of instrument panel board includes pilot lights, relays, etc

*Condensed from a report by*
**ARNOLD FEATHAM**
**and**
**B J McCAUSEY**
*Research Department*
*The Detroit Edison Co*




**4** Pressure-change indicator includes main pressure chamber holding brass chamber and mercury manometer to register pressure variations. Relays operate lights




**5** Chart shows that pressure changes of 1.5 psi per min will not flash indicating lamps; 2 psi per min lights lamps in 2 sec

**Operating Principles.** Fig. 4 shows the principal operating parts of the instrument schematically. Pressure chamber connects through the bottom part to the main steam line. The lower part holds condensate, while nitrogen under pressure fills the remainder. Above its center a web support holds a brass chamber. This is closed except for an orifice tube connecting with the main pressure chamber. A mercury manometer in the brass chamber has one end open within the latter and the other open to the main pressure chamber.

For steady steam pressure, nitrogen pressure within main and brass chambers is equal. When steam pressure drops, main chamber's nitrogen pressure drops. This causes a flow of nitrogen from the closed brass chamber through the orifice tube into the main chamber. The difference in pressure acts on the mercury heights in the manometer legs.

When steam pressure rises, the main chamber's nitrogen pressure rises above brass chamber's pressure, reversing the relative heights in the mercury manometer legs. Nitrogen then flows from main chamber into brass chamber.

Gas flow through the orifice tube always acts to equalize gas pressure in the two chambers. Time needed for equalization depends on both the magnitude of steam-pressure change and dimensions of the orifice tube.

Pressure difference varies the position of mercury in the manometer. Electrodes in the manometer legs make contact with the mercury whenever the pressures are unequal. Contact in right leg registers steam-pressure increase, in left leg a pressure decrease.

**Design.** In the connecting steam line, Fig. 4, the T-fitting with valve allows purging the line or connecting a pressure gage. Upper part of pressure chamber is filled with nitrogen through the upper connection to a gas bottle, see Fig. 2.

The nitrogen prevents condensate from rising and contacting the brass chamber. Any gas will do this job, but nitrogen minimizes oxidation of mercury in the manometer. Electric circuit through the mercury is completed by the platinum ground wire. This lights the indicator lamps through the circuit of the pressure-change relay unit.

Condensate electrodes show level of the condensate through circuit of the water-level relay unit, and pilot lights

mounted on instrument panel, Fig. 3. Fig. 1 shows the pilot gage board at Delray power plant. One indicator lamp is mounted behind the translucent letters *Incr* and the other behind *Decr*.

**Pressure-Change Element.** Great flexibility in meeting the 5-sec response for 2-psi-per-min pressure changes is provided by adjusting electrode-to-mercury spacing. Relative dimensions of the orifice tube and volume of the brass chamber were fixed by the need for the pressure-change element returning to normal and being ready to indicate next pressure change within 5 sec. These dimensions were found by the following formulas:

$$p = AK\ (1 - e^{-\frac{t}{K}}) \qquad (1)$$

where

$p$ = pressure difference between inside and outside of container, psi
$A$ = rate of change of steam pressure, psi per sec
$K$ = constant from formula (3)
$t$ = time in sec

If steam-pressure change stops when pressure difference between inside and outside of container is at some value $p_o$, pressure difference will decay with time as follows:

$$\frac{p}{p_o} = e^{-\frac{t}{K}} \qquad (2)$$

So the instrument would be ready to indicate the next pressure change within 5 sec, it was required that the pressure difference $p$ should decay to a small value, say 1% of $p_o$, within that time. This means the ratio $p/p_o$ is 0.01 when $t = 5$. Substituting these numbers we find $K = 1.09$. Constant $K$ also depends on other factors:

$$K = \frac{128\mu LV}{\pi P_o k D^4} \qquad (3)$$

where

$\mu$ = nitrogen viscosity in lb (force) sec per sq in. at $P_o$ (634.7 psia) and 30 C
$L$ = orifice-tube length, in.
$V$ = brass container volume, cu in.
$P_o$ = nominal steam-line pressure, psia
$k$ = ratio of specific heats of nitrogen = 1.41
$D$ = orifice-tube inside diameter, in.

$L$, $V$ and $D$ have to be chosen to get the proper value for $K$. Physical considerations fix dimensions of the brass chamber, such as, sufficient room for enclosing manometer and mounting relief valves, Fig. 4. Relatively large volume avoids using an orifice tube of small diameter that might be clogged by small dirt particles, and avoids a length causing installation problems. This led to choosing a volume of 34.47 cu in. for the brass chamber.

To select $L$ and $D$, we substitute the determined values in (3), setting $K = 1.09$, and find:

$$\frac{D^4}{L} = 39.8 \times 10^{-10} \qquad (4)$$

There's room in the chamber for about 6 in. of straight tubing, $L$. This makes $D = 0.0124$ in. Commercial hypodermic needle stock has an inside diameter of 0.013 in. Using this makes $K = 0.911$. This is smaller than required, but proves satisfactory if pressure change specifications are met.

To check electrode-to-mercury spacing substitute final dimensions in (1). Assuming a linear change in steam pressure of 2 psi per min or 1/30 psi per sec, we get:

$$p = 0.0304(1 - e^{-\frac{t}{0.911}})$$

This equation gives the solid curve in Fig. 5. It shows that at the end of about 2 sec, $p$ across the manometer is 0.0266 psi or 0.0532 in. Hg. At this instant the rising side of the mercury column should contact the electrode above it. This means the electrode-to-mercury spacing should be set at half of $p$, or 0.0266 in., when there is no pressure difference. This gives a response well within the specified 5-sec interval.

Fig. 5 also shows a steam-pressure change of 1.5 psi per min. The corresponding pressure difference across the manometer never intersects the line $p = 0.0266$ psi, indicating electrode-mercury contact. Therefore, changes slower than about 2 psi per min don't indicate.

Rapid fluctuations in steam pressure small enough so $p$ stays less than 0.0266 psi will not indicate, even though instantaneous rate of change is much greater than 2 psi per min. This is good because small fluctuations do not affect boiler operation, and indicating them would only be confusing.

Though the theory of operation as we explain it is not exact in all details, it is good enough as a starting point for design purposes. Final adjustments are made on the basis of operating experience. Electrode-adjusting screws and orifice tubes of different diameters give a wide range of possible adjustments.

**Pressure-Change Relay.** This unit has two identical parts, one for increase, and the other for decrease. Looking at the "increase" circuit in Fig. 4, you'll find indicator lights in series with a parallel circuit consisting of a condenser and primary of a transformer. When the FG-17 thyratron tube is not conducting, secondary of the transformer is open, and this parallel circuit is about anti-resonant at the supply frequency of 60 cycles. It then has a high impedance and not enough current flows through the lamps to light them.

To keep the thyratron from conducting, its grid connects to a tap on the secondary, which is negative by 50 v (rms) when the plate is positive. When the rising mercury column grounds the manometer electrode, the grid potential drops to zero and the tube conducts. This places a low resistance across the secondary and brings the effective impedance of the primary to a low value every half cycle. Under this condition, the average current through the lamp circuit causes the lamp to light or indicate. The "decrease" part of the circuit works the same way.

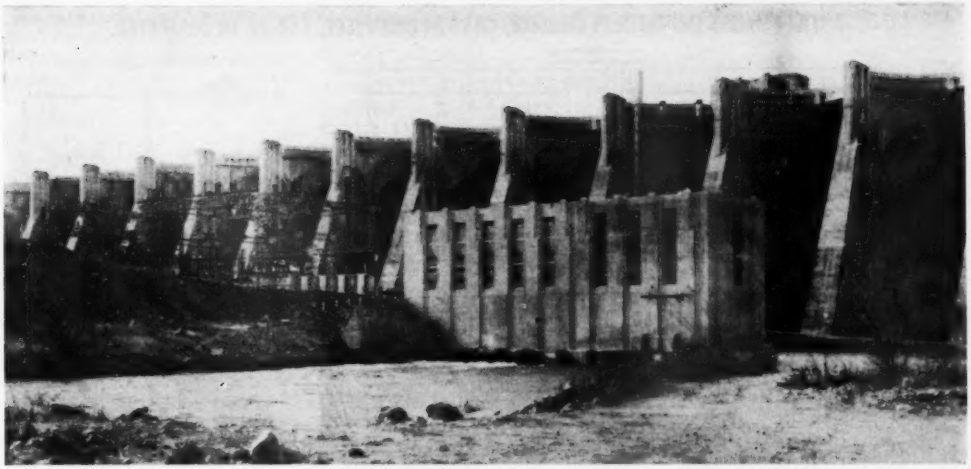
We find the thyratron has three advantages over ordinary relays: (1) Ordinary relays do not stand up under the high frequency of operation. (2) Thyratron circuit uses only about 100 microamp through the electrode-mercury contacts, minimizing their deterioration. (3) With a thyratron circuit enough current flows through the lamps when not indicating to maintain them at a temperature just below incandescence. This greatly lengthens lamp life.

**Water-Level Relay.** When the condensate level is within proper limits, the lower electrode connects to ground through the water. This completes the circuit of the closing coil of the relay and the "normal" pilot lamp lights. When the condensate rises and contacts the upper electrode, another relay lights the "high" pilot lamp.

This means that more nitrogen should be admitted from the nitrogen bottle. With a reasonably tight system, this should be needed rarely, say once in six months.

**Condensation.** Trouble was experienced from water vapor condensing on top of the pressure-change element. Increasing steam pressure raises the condensate-water column and decreases the volume occupied by the nitrogen and water vapor. This condenses some of the water vapor. To prevent this condensation in upper part of the chamber, a small disk heater was mounted on top of the cover. This keeps the upper part of the chamber about 10 F warmer than the lower part.

**Acknowledgments.** Valuable contributions to the design and development of the pressure-change indicator were made by various members of the production and research departments of The Detroit Edison Co. Particular mention should be made of T A H Jeffrey, a former co-worker, for a considerable amount of early design and construction work.



1 Buchanan dam and powerhouse in which are installed three 12,500-kva generating units operating under 132 head and a 362,000-gpm vertical-shaft pump. Dam is a multiple-arch concrete structure. It is 150 ft high and 11,200 ft long

# Pump at Buchanan Dam Adds Peak Capacity to Power System

**To store water for high-value peak energy in hydro units, a 13,450-hp pump unit uses low-cost off-peak steam power. In average year, pumped water increases hydro 21,000,000 kwhr**

By C L DOWELL, *Results Engineer*
*Lower Colorado River Authority*
*Austin, Texas*

► DOWN IN CENTRAL TEXAS, water of the Colorado River gets a merry whirl to make it do double duty. Not content with a series of dams and generating plants, to use the water many times on its way to the Gulf of Mexico, the Lower Colorado River Authority recently placed in operation one of the two large pumped-storage units in the U. S. Pump, rated 362,000 gpm under a 120-ft head, is driven by a 13,450-hp motor. The Rocky River plant of the Connecticut Light and Power Co was placed in operation in 1938 (POWER, Dec. 24, 1929). This plant has a 30,000-kva hydro-electric unit and two pumps, each driven by 8100-hp synchronous motor. Head on the pumps varies from 200 to 230 ft depending on water level in the storage reservoir.

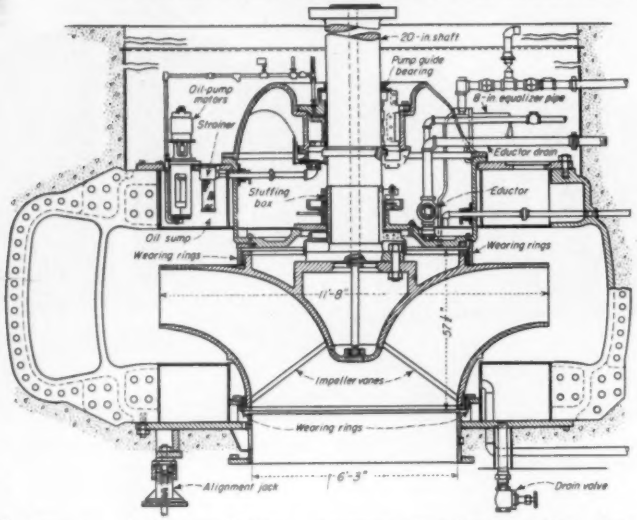
The Lower Colorado River Authority, State of Texas agency, owns and operates a series of multipurpose projects on the Colorado River in central Texas. At present, four major hydroelectric plants totaling 150,000 kw are in operation. These, with a 60,000-kw steam-turbine generating plant at New Braunfels operating under lease agreement, give a total system capacity of 210,000 kw. Two other projects, Granite Shoals and Marble Falls, are nearing completion with 75,000-kw additional peaking capacity. All the fall in the river from Austin to above Buchanan will then be used.

**Generating Plants.** Buchanan Dam Plant, Fig. 1, is about 70 miles northwest of Austin. It is 150 ft high, 11,200 ft long, and is a multiple-arch and concrete-gravity structure. The main river section of the dam has twenty-nine 70-ft and twenty-three 35-ft arches. Three spillway sections have 37 tainter gates for a 585,000-cfs discharge capacity. The lake is 32 miles long with 22,000 acres area and 1,000,000 acre-ft storage. Original power installation had two 12,500-kva generating units with penstocks. The intake structure and head gates were installed for a third unit. Maximum operating head is 132 feet. Unit No. 3 of the same capacity as No. 1 and 2 went into service in 1949.

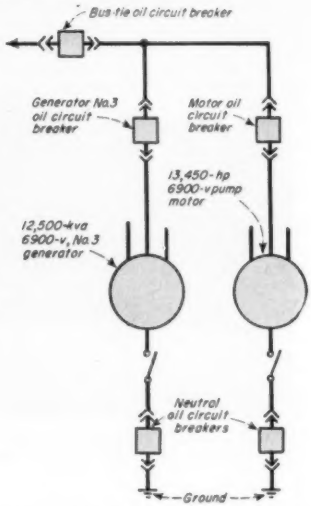
Inks Dam and power station, three miles downstream from Buchanan, has a concrete-gravity dam 100 ft high, 1550 ft long with an uncontrolled spillway section. The lake has 900 acres and stores 16,200 acre-ft and operates at practically constant level. It regulates discharge from Buchanan, and its headwater elevation is the tailwater at Buchanan. Inks has one 12,500-kva unit under 62-ft head controlled from Buchanan plant.

**Requirements.** Transmission-line connections, to several steam electric systems, provide a source of low-cost off-

## THE PUMP'S IMPELLER IS BRONZE, CAST IN ONE PIECE, 140 IN. IN DIAMETER




**2** Pump is a 164-rpm vertical-shaft twin-volute closed-impeller design. Cast-iron suction elbow changes from circular at pump to elliptical at bottom end




**3** Pump started by connecting its motor with field excited to a generator

peak energy, which is the first requirement for a pump-storage unit. This energy is available at slightly above fuel cost because investment, labor, depreciation and other costs continue whether or not the facilities are in use. The next requirement, a supply of water available for transfer to a reservoir feeding a hydro plant, was present at the Buchanan and Inks projects. Finally, a market was available for peak energy at a price that offsets the pumping cost.

Peak capacity and energy are worth about four times the cost of off-peak energy used to operate the pump motor. There are times also when the third unit can operate from flood flow to supply power with water that would otherwise discharge through the flood gates without doing useful work. All this made it economical to install a third generating unit and a pump to supply a large part of its water.

**Selecting Equipment.** Because standard high-efficiency hydroelectric equipment could be purchased on fair delivery time and at established cost, no consideration was given to a special combined pump and hydroelectric unit such as several foreign countries use, or to the pump-turbine unit being developed in this country. Bids were received and contract awarded to Baldwin Locomotive Works for the turbine, and to Westinghouse Electric Corp for the generator for the third power unit.

When determining pump size, consideration was given to the number of hours of peaking load and the time that off-peak steam-station energy was available. Peak-load season in Texas is June, July, August and September, and daily peak is between 3:00 and 5:00 pm. This is due to air conditioning, refrigeration, irrigation, water pumping and industrial loads all being maximum at this time. Pumping time is from 11:00 pm to 7:00 am each night with a possible 24-hr period for Sunday and holidays.

**Pumping Unit.** It was fortunate that, at the time bids were called for on the pumping equipment, Worthington Pump and Machinery Corp had large units in the production stage for the U.S. Bureau of Reclamation's Tracy pumping plant, Central Valley Project, in California. These pumps, with a slight change in the impeller's diameter, could be used for Buchanan with early delivery and below competitive price.

Main features of the pump are shown in Fig. 2 and 5. It is a 164-rpm vertical shaft, bottom-suction, twin-volute, closed-impeller design. The cast-iron suction elbow changes from circular at the pump to elliptical horizontal intake, which connects to the tailrace by a concrete intake section. Trash racks protect the intake and the concrete piers have grooves for steel gates for unwatering the pump for inspection. As shown in Fig. 5, center line of the impeller is 4.75 ft below normal tailwater level. This is sufficient to insure the pump being primed at all times and to prevent cavitation in the impeller.

**Discharge Valve.** The pump's 75-in. discharge bolts to a section of steel pipe enlarging to 12 ft and making a Y-welded connection to the 12-ft penstock from the forebay to No. 3 turbine scroll case. Between the pump discharge and penstock a 12-ft S Morgan Smith motor-operated butterfly valve serves several purposes. By starting the pump against a closed discharge, the motor can be gradually loaded by opening the valve in about one minute. When necessary the valve isolates the pump so No. 3 turbine-generator can operate. The valve's dc motor operates from the plant's battery system controlled by relays to close the valve if power fails to the pump motor.

**Pump Motor.** Pump is driven by a Westinghouse Electric Corp synchronous motor, rated 13,450 hp, 0.80 pf, 6900 v, 164 rpm. This motor, Fig. 4, has an enclosed cooling system the same as the generator, with forced-air circulation by fans on the rotor. Cold water from the penstocks passes through the cooling coils by gravity to the tailrace.

Large size of the motor made its starting a problem. Generators and motor are both 6900 v and the double-bus arrangement simplifies starting. Motor and one generator are isolated

on one section of the bus, Fig. 3, and excited. When water is admitted to the turbine, both units start and come up to speed with the pump's butterfly valve closed. They are then synchronized to the other bus and the tie breaker closed, allowing the motor to take power from outside the plant. The butterfly valve is then slowly opened to load the motor. Load is reduced on the starting unit and finally taken off the line, leaving the pump operating normally.

This procedure allows smooth operation without sudden demand on the power systems. When the pump delivers rated capacity at 120-ft head, the motor requires 10,000 kw. After the motor and generator are operating at synchronous speed with the butterfly valve closed, the load is about 5000 kw.

Latter part of the starting operation can be reversed. That is, take the generator off the line before opening the valve. This was our first starting procedure, but it required longer pumping against the closed valve. We find the other method is the best. The valve opens in 50 sec, but power flow from the steam plants does not respond this fast. It takes about 4 min to back the generator off the line and transfer the pump load to the steam plants without voltage surges on the system.

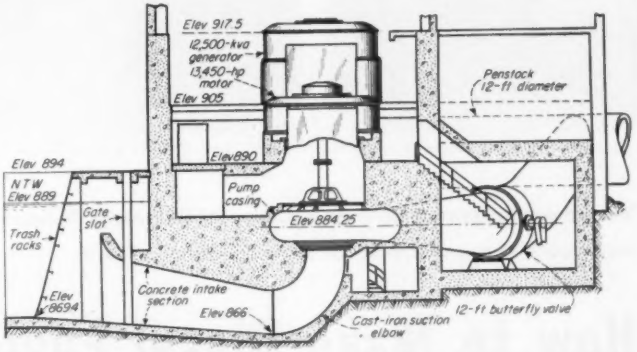
**Reverse Rotation.** If power fails to the pump motor, rotation of the unit reverses, but the butterfly-valve motor operates on dc from the station storage battery. Relays automatically close the valve so reverse runaway speed of the pump does not occur when power fails to its motor. We have made this test and maximum reverse speed is about 100 rpm because impeller running in water has some braking action. To take care of the most severe conditions that can develop, the motor is designed for 28% overspeed, or 210-rpm reverse rotation. Pump runner is also designed for reverse rotation at full head.

**System Operation.** Eight-hour operation lowers Inks Lake about 6 in., while a weekend 24-hr period may cause a 2-ft drawdown. Buchanan units start first after the pumping cycle ends to bring Inks Lake back to normal level before the unit in that plant starts, so power is not lost because of the drawdown. The pumping cycle does not alter the amount of water passed downstream during normal operations.

The motor has a lower guide bearing so it can run disconnected from the pump for a field test. Its efficiency is 97.4%, which was above the 97.1% guarantee. Pump has not been tested but the factory-model test indicates efficiency of 90% or better. Over-all efficiency of the combined units for the cycle of operation is about 70%.

## THE MOTOR'S LARGE SIZE MADE STARTING A PROBLEM

**4** Pump is driven by 13,450-hp 164-rpm synchronous motor that has an enclosed cooling system in which ventilating air circulates and is cooled by water

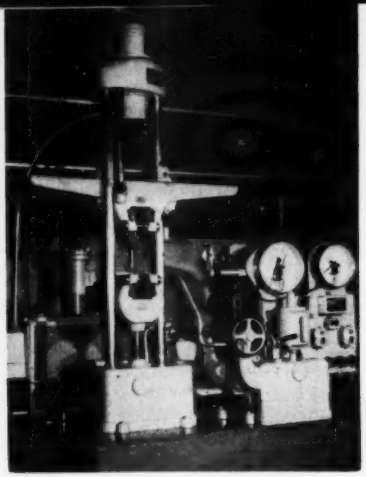



**5** Center line of the pump's impeller is set 4.75 ft below normal tailwater level. This is enough to insure that the pump will be primed at all times

Kilowatt-hours gained from the pumping unit vary with river flow. But with an average water year the pump may operate 3000 hr with 21,000,000-kwhr return.

It was necessary to extend the powerhouse building to provide space for No. 3 generator and the pump. This work was done under contract. The Lower Colorado River Authority installed all the equipment under general supervision of the manufacturers' representatives. Fargo Engineering Co, Jackson, Mich. and Austin, Texas, were the consulting engineers with A Streiff supervising the design. The Authority's general office is at Austin, with Max Starcke as general manager.

**VIBRATION ANALYSIS** of diesel fuel pump engages lab technician. Such investigations of engine components form a fundamental part of the laboratory's operations



**FATIGUE TESTER,** of Losenhausen pulsating type, aids in work on materials

**MACHINE SHOP,** including this Lindner jig borer, turns out experimental parts

**FOR PRECISION EQUIPMENT** used in instrumentation and testing there is this separate precision shop in addition to the large machine shop handling most lab work

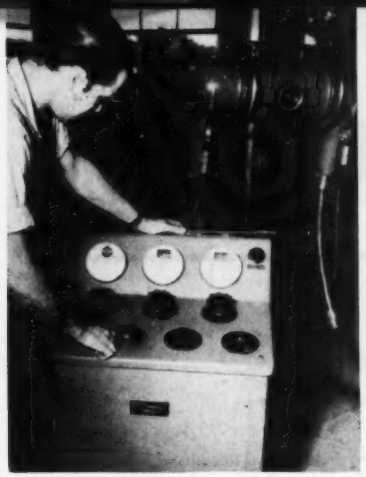
***Started with captured German equipment, Oklahoma Power and Propulsion Lab has grown to a great research center. It aims to learn . . .***

# How to Make Diesel Engines Better

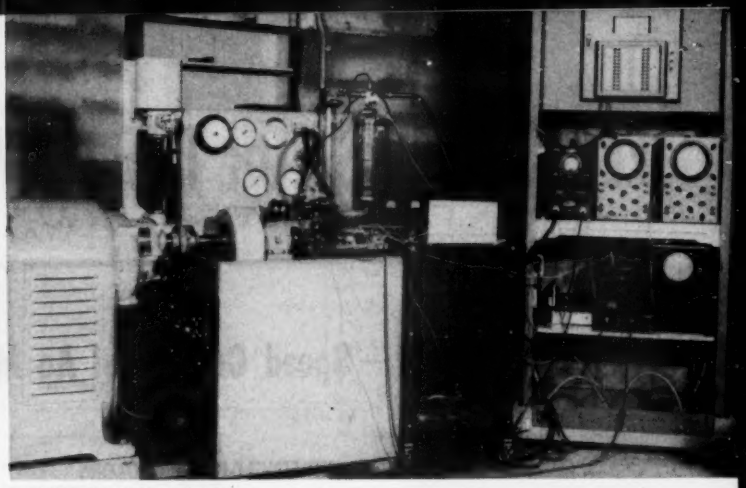
► BACK IN 1945, when Allied technical missions were crisscrossing Germany, a group of U.S. diesel specialists came to Oberusel, home of the Klockner, Humboldt & Deutz engine works. Here they found an unusually large and well-equipped diesel laboratory. It was subsequently shipped to the U.S., with final disposition in charge of a committee representing various government agencies.

**Nucleus** of the Oklahoma Power and Propulsion Laboratory, on the campus of Oklahoma A & M, at Stillwater, was a portion of this German equipment. It was housed in Quonset-type buildings and a staff organized. Then began the job of reconditioning the German equipment, arranging it for effective experimental work, adding needed test gear and providing auxiliary facilities.

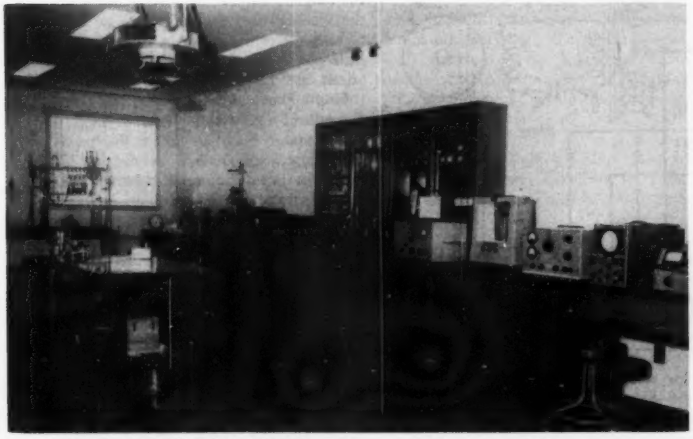
**German equipment included:** (1) Several fuel-pump and injection test stands, which were "cannibalized" to make one good one in each of two categories. (2) Four test engines—two diesel and two gasoline-injection. (3) Numerous water brakes of which seven were retained. (4) An excellent 250-kv metallurgical X-ray unit made by Rich-Seifert of Hamburg. (5) A Lindner jig



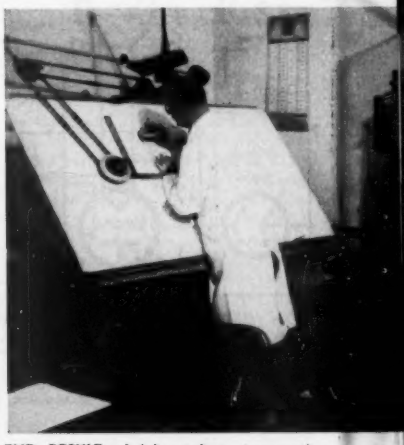
**MATERIALS STUDIES** are also aided by this 250-kv X-ray unit from German lab



**FUEL-INJECTION TEST STAND,** "cannibalized" from original German units, is used with electronic instrumentation being developed by laboratory's own specialists



**ELECTRONIC INSTRUMENTATION** plays an important part in lab's testing programs. Here new devices are developed and those in regular use are calibrated, repaired



**END RESULT** of lab work is improved design of components or full engines

borer and Deckel pantograph and tool grinder. (6) Two Losenhausen pulsator fatigue-testing machines (20- and 60-ton) plus smaller fatigue-testing units. The Losenhausen machines operate with a predetermined stress (either tension or compression) through a variable cycle without stress reversal.

**Facilities Added.** Biggest need then was instrumentation, which was almost entirely lacking for the German equipment. All new electronic equipment was added, including special devices developed at OP&P Lab. Shop facilities were rounded out. Laboratories for basic chemical, physical and petroleum work were added. And so were the auxiliary facilities needed for an integrated operation—photographic equipment, drafting and design offices, library and facilities for the publication of reports.

Under W S Burn, technical director, 16 scientists, engineers and technicians selected from industry form the permanent staff. Members of Oklahoma A & M faculty assist in basic research on a part-time basis. Senior students are employed as assistants.

**Over-all objective** of the OP&P Lab is development of better internal-combustion engines—engines that can operate more efficiently on cheaper fuels. Freedom to apply new concepts and original methods unhampered by tradition or immediate manufacturing requirements is a major advantage, the staff believes. The Lab also provides opportunities for faculty members and advanced students to do research under modern and efficient conditions.

Facilities of the Laboratory are available to industry on a contract basis. It is now equipped for work on (1) internal-combustion engine, gas turbine, air compressor, propeller and power-transmission development and design (2) fuel-injection and combustion analysis, (3) experimental stress analysis (4) instrument and electronic design and development (5) mathematical analysis and computation.

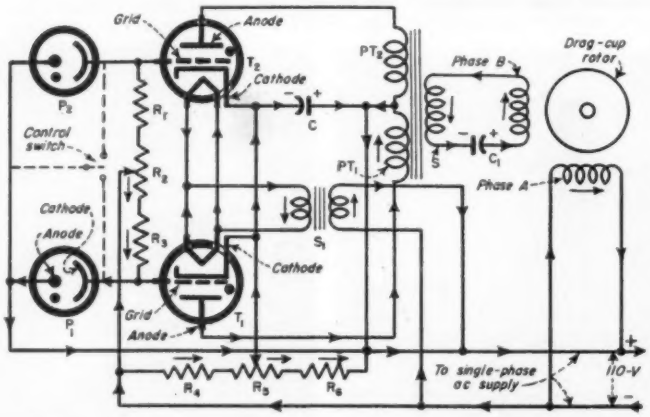
**A & M Engine.** One of the most interesting current projects is the so-called A & M engine. A combination of reciprocating engine and gas turbine, this unit is being developed from the ground up by the Laboratory staff and faculty research associates—from theoretical analysis through development studies to final design and testing.

# ELECTRONICS FOR THE POWER ENGINEER

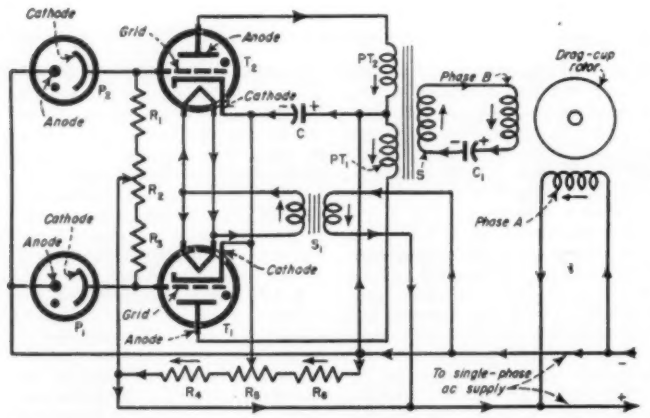
By F A ANNETT, *Associate Editor*

## 40—Speed Control of Ac Motors

### SPEED-CONTROL OF DRAG-CUP SINGLE-PHASE MOTORS




**1** Diagram of electronic reversing control for small single-phase motor such as might be used where low horsepower is required, as in the control applications




**2** Same control as Fig. 1, but with current reversed in the power circuit. Current reverses in both phase windings of motor, so does not reverse rotation

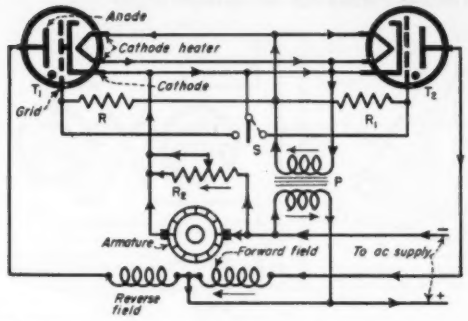
► So far our studies of electronic-speed control of motors on ac systems have applied to dc types. With these, ac power is rectified to dc for driving the motor. Here we will study some of the systems used for control of ac motors. Some of the motors are fractional-horsepower single-phase types while others are large polyphase units.

**Single-Phase Control.** Fig. 1 is a diagram of a control for a small single-phase motor such as might be used where low horsepower is needed, as in meters or in control applications. The drag-cup rotor is an aluminum or copper cup inside a laminated core with a distributed 2-phase winding. When connected to a single-phase circuit a capacitor $C_1$ connects in series with phase $B$ winding to give a 90-deg phase shift for producing a 2-phase rotating magnetic field. The rotating magnetic field generates eddy currents in the drag cup that react on the magnetic field to produce torque.

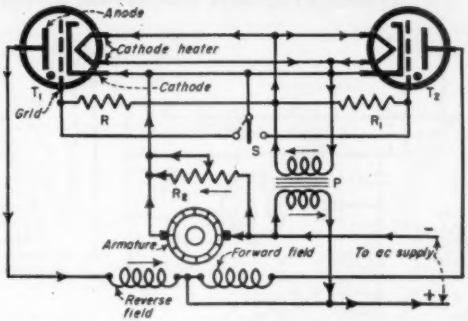
Control is arranged with two photoelectric tubes $P_1$ and $P_2$. When both are dark or illuminated, the motor does not rotate. But illuminating one tube causes the motor to rotate in one direction and illuminating the other gives reverse rotation.

Assume the line polarity shown. Current then flows through phase $A$ of the motor as shown, and transformer $S_1$ is made alive to heat the cathodes of amplifying tubes $T_1$ and $T_2$. When tubes $P_1$ and $P_2$ are not illuminated a minus bias is applied to the grid of tube $T_1$ from — line through resistors $R_2$, $R_3$, grid and cathode of $T_1$, resistors $R_4$ and $R_5$ to + line. A minus bias is also applied to tube $T_2$ through resistors $R_2$ and $R_1$, grid to cathode of $T_2$, resistors $R_5$ and $R_6$ to + line. Full-line volts are applied across resistors $R_4$, $R_5$ and $R_6$ from — to + lines. Bias on tubes $T_1$ and $T_2$ equals line volts less the drop across $R_6$ and part of $R_5$. Assume the tubes blocked by this bias, which can be adjusted by moving the contact on $R_5$. Moving this contact to the right in-

## REVERSING CONTROL FOR UNIVERSAL SERIES MOTOR USING DIVIDED FIELD WINDING




**3** Diagram for electronic control of a universal motor, a special series type to operate on ac or dc power supply




**4** Switch $S$ closed to the left for reverse rotation. Tube $T_2$ conducts through the other half of the field winding

creases and to the left decreases the bias.

**Control Operation.** Assume phototube $P_1$ illuminated. Current then flows from — line through resistors $R_2$ and $R_3$, cathode to anode of $P_1$ to the + line as indicated. Volts' drop across $R_3$ and part of $R_2$ reduces the bias on tube $T_1$, and it conducts. Its circuit is from — line through $R_4$, part of $R_3$, cathode to anode of $T_1$ up through primary winding $PT_1$ to the + line. A voltage is induced in secondary $S$ and a current flows through capacitor $C_1$ and motor winding $B$ as indicated. This caused the motor to rotate in one direction and charges capacitor $C_1$ to the polarity shown. Capacitor $C$ is also charged to a voltage equal to that across $R_4$ and part of $R_3$.

When line polarity reverses as in Fig. 2 tubes $P_1$ and $T_1$ cannot conduct. But current flow reverses in motor phase $A$. Capacitor $C_1$ discharges as indicated through secondary $S$ and motor phase $B$. Current has reversed in both phases so motor continues to run in same direction. Current flow in $S$ induces a voltage in $PT_1$ and $PT_2$ as shown. Voltage of $PT_2$ is in series with that of capacitor $C$, which discharges through tube $T_2$. Current flow in $PT_2$ is opposite to that in $S$, and prevents the latter from acting as a choke coil in phase $B$ circuit. Otherwise, $S$ would have a voltage induced in it that would prevent normal current flow in motor-winding phase $B$. Capacitor $C$ also tends to discharge from cathode to anode of tube $T_1$, but we can assume this is prevented by the voltage induced in $PT_1$ by winding $S$.

**Reverse Operation.** Referring to Fig. 1, if light shines on photoelectric tube $P_2$ instead of $P_1$ the motor will reverse.

With the line polarity shown, current flows through motor phase-$A$ winding in the same direction as when $P_1$ conducted. Light shining on $P_2$ reduces the minus bias on $T_2$ and this tube conducts, from the tap on $R_3$, from cathode to anode of $T_2$, down through winding $PT_2$ to + line. Current flow through $PT_2$ is the reverse of that in $PT_1$ so current also reverses in $S$ and in motor phase-$B$ winding. Since the current is in the same direction in $A$ but reversed in $B$, motor's direction of rotation reverses.

Capacitor $C_1$ is charged to the opposite polarity of that shown, but $C$ is charged to the same polarity. When line polarity reverses, capacitor $C_1$ discharges up through phase $B$ and down through $S$. Voltage in $PT_1$ will be up and in series with that of $C$ for the latter to discharge through $T_1$ to produce the effects explained for $T_2$.

Instead of using photoelectric tubes to control the output of tubes $T_1$ and $T_2$ a 2-point switch may be used connected as indicated by the dotted lines, Fig. 1. This switch may be closed and opened by a meter pointer, temperature, pressure, position or other means.

**Universal-Motor Control.** Fig. 3 diagrams an electronic control of a universal motor, which is a series type designed to operate on either ac or dc. The motor has two field windings, one for forward rotation and one for reverse. Diagram shows a simple on-off control system in which a sensitive contact starts and stops the motor. This contact may be actuated by a meter pointer, temperature, position, pressure or other medium.

Secondary of potential transformer $P$ supplies heating current for the cathode heaters as indicated by arrow heads. This transformer also applies a minus bias to the grid of thyratrons $T_1$ and $T_2$ so when contact $S$ is open neither tube conducts. The grid circuit with the polarity shown is from the left-hand side of the transformer, through $R$ and $R_1$, from grid to cathode of each tube and to the right-hand side of the transformer. As long as contact $S$ remains open, minus bias on the grids blocks the tubes and the motor cannot start. On reverse line polarity the grids have a plus bias but polarity on the tubes is reversed and they cannot conduct.

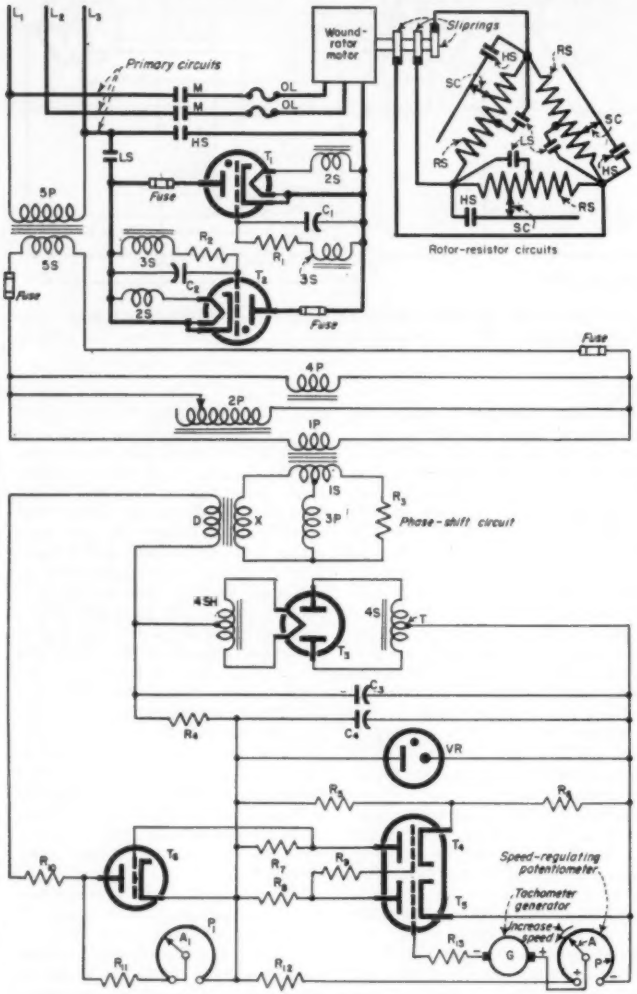
**Control Switch.** Assume the line polarity shown and control switch $S$ closed to the right as indicated by the dotted line. Closing $S$ shunts the grid circuit of $T_2$, which is now through resistor $R_1$ back to $S$ and to the right-hand side of the transformer. The bias being removed from tube $T_2$, it conducts. Current flows from — line through the armature to the cathode and anode of $T_2$, through the forward field winding to the + line. The motor then starts and runs in the forward direction until contact $S$ opens and the grid of $T_2$ is again given a minus bias.

Closing control switch $S$ to the left. Fig. 4, removes the bias from tube $T_1$ and it conducts. The motor circuit is now from — line through the armature, cathode to anode of tube $T_1$, the reverse field winding to the + line. Reversing the current in the field winding causes the motor to reverse its direction of rotation. Motor speed can be adjusted by connecting an adjustable resistor across the armature as shown. This resistor increases the current through the field coils and slows down the motor.

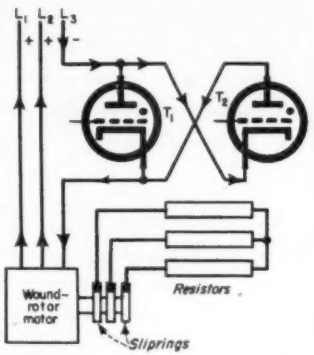
Where a wide-range speed control is required it can be obtained by adding a phase-shift device to the grid circuit to control the output of the tubes, as in Fig. 5. Electronic control is applied to several other types of small ac motors, but the two described give a general idea of their operation.

**Polyphase-Motor Control.** Several methods of electronic speed control of

# INVERSE-PARALLEL CONNECTION OF THYRATRONS CONTROLS AC-MOTOR SPEED




**5** Electronic control circuits for obtaining stable performance from slipring motors over wide speed ranges down to crawl by unbalance primary connections




**6** Simple inverse-parallel connection of two thyratrons in motor primary

polyphase motors have been developed. Here we will consider unbalanced primary control of slipring polyphase motors. A 3-phase slipring motor operating with resistance in the rotor circuit will run at a much slower speed on single-phase power than on 3-phase. For example, if on 3-phase the speed is 50% normal, the single-phase speed may be only 10%. Then, by opening and closing one of the power leads we can switch from single to 3-phase operation and obtain any speed between 10 and 50% of normal. During each switching period the longer the motor operates on 3-phase the nearer the speed will be to 50% rated value.

Fig. 5 diagrams a Cutler-Hammer control that does the switching operation by electronic means. Only the electronic and motor circuits are shown. The control parts used in normal operation of the motor have been omitted to simplify the diagram. Above 50% speed the electronic control is cut out and the motor's speed adjusted by rotor resistors *RS*. During this operation, contacts *M* and *HS* are closed in the primary circuits. In the rotor circuits, contacts *HS* are closed and *LS* open. Under this condition the amount of resistance in the rotor circuits is determined by the position of contacts *SC*, which are part of a motor-driven controller.

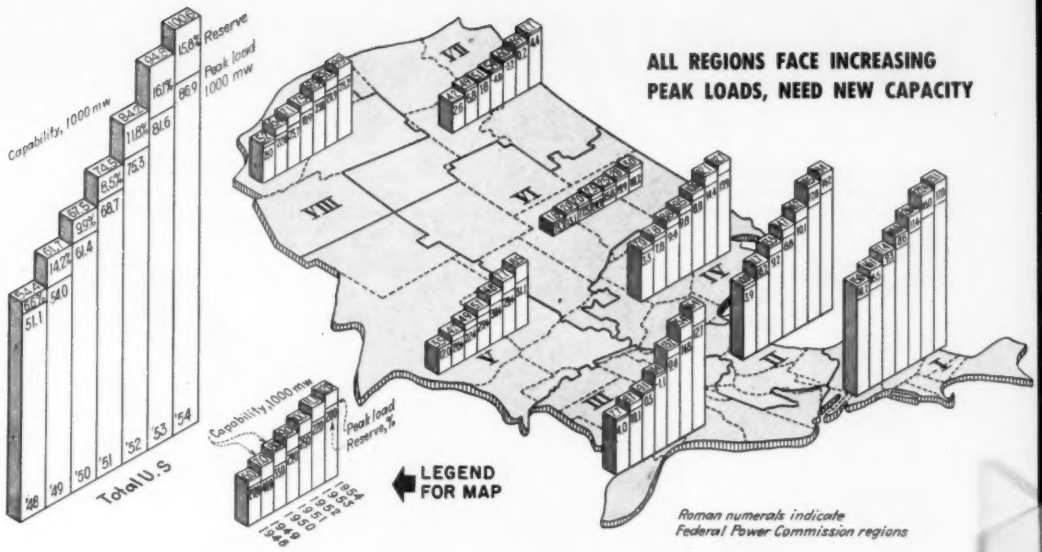
During electronic speed control primary contacts *M* and *M* are closed, *HS* is open and *LS* closed to connect thyratron tubes $T_1$ and $T_2$ in series with the lower leg of the primary circuits. By turning the thyratrons on and off, operation can be changed from three to single phase and motor output speed controlled accordingly.

**Inverse Parallel.** In the rotor circuits contacts *HS* are open and *LS* closed. When the latter contactors are closed there is sufficient resistance in the rotor circuit to give the lowest required speed on single-phase operation. Thyratrons $T_1$ and $T_2$ are connected in what is known as inverse parallel, Fig. 6. That is, one tube conducts on one polarity of the circuit and the other conducts when line polarity reverses.

For example, if line $L_3$ is minus, current can flow from cathode to anode of tube $T_2$ and to the motor. When line polarity reverses and current flows from the motor to line $L_3$, current flows from cathode to anode of tube $T_1$ and to line $L_3$. That is, when the tubes conduct, the motor operates 3-phase on either line polarity.

Transformer secondary 5*S*, Fig. 5, supplies ac power to the electronic system. Secondaries 2*S* heat the cathodes of thyratrons $T_1$ and $T_2$ and are energized from transformer primary 2*P*. Firing of thyratrons $T_1$ and $T_2$ is controlled by the phase-shifting network consisting of resistor $R_5$, saturable reactor *X* energized by transformer sec-

(*Continued on page* 194)




# U.S. Power Capacity Zooms to New Highs

**New defense loads plus natural growth of U.S. economy keep power-plant capability expanding at an all-time rate**

► CHART, ABOVE, TELLS the story of actual demand and plant growth in the U.S. for 1948, 1949, 1950. Peak loads and total capabilities, existing and scheduled for installation, are estimated yearly to include 1954. These figures are the result of EEI's Ninth Semi-Annual Electric Power Survey.

Regional capabilities equal the sum of the capabilities for individual systems serving the areas. Systems normally interconnected were treated as a single system. System capability equals maximum peak load that can be carried with all power sources available, with no allowances for outages, and with enough energy to take care of integrated system needs. Operating experience determines existing capability. Projected unit capability is figured from design data and expected operating conditions. Figures above for 1951-4 are based on median hydro conditions.

Estimated peak loads for each region are the totals of December peaks for each system, taking account of diversity on interconnected systems. Reserve margins in the chart are written in percent of peak load. This margin equals capacity for (1) maintenance and emergency outages during peak load (2) normal operating needs (3) unforeseen loads. For some systems the reserve margin may be lower during off-peak periods than during peak.

Comparing these latest figures with the Eighth Semi-Annual Survey, see POWER, Dec 1950, pp 80-2, shows defense loads have boosted original estimates. This lowers the reserve margin originally anticipated by about 39 and 28%, respectively for 1951 and 1952, to that shown above.

National load factor for the 7-year period varies from 61.9% for 1948 to a low of 60.5% for 1950. This is expected to grow to 62.7% by 1954.

**Equipment Production.** Ability to meet predicted peak loads wtih safe margin of reserve hinges on output of equipment manufacturers. Estimates given below assume that both raw materials and manpower are available as needed. These figures are given in terms of nameplate capacity. Capability will be higher in most cases.

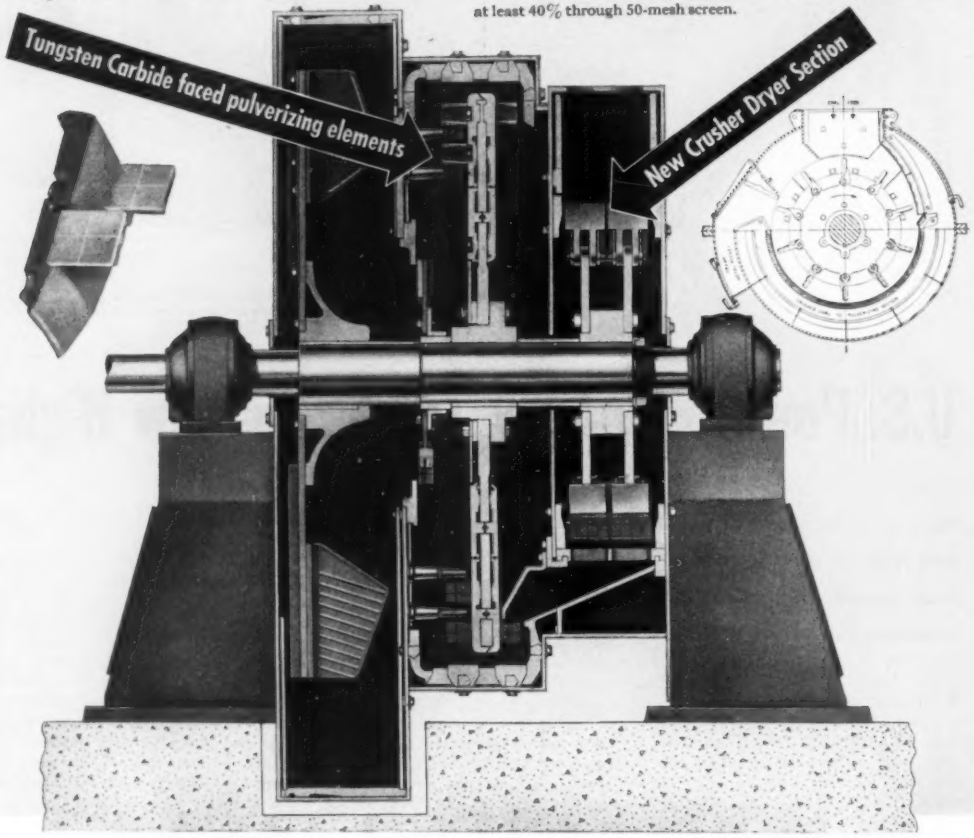
## CURRENT SHIPMENTS AND ORDERS BOOKED FOR POWER EQUIPMENT

| Year | 1948 | 1949 | 1950 | 1951 | 1952 | 1953 | 1954 |
|---|---|---|---|---|---|---|---|
| **Large steam turbine-generators (10,000 kw and up)—1000 kw** | | | | | | | |
| For continental U.S. utilities | 4276 | 4532 | 4854 | 5125 | 8502 | 8114 | 1209 |
| For continental U.S. industrials | 170 | 252 | 130 | 430 | 750 | 140 | — |
| For outside continental U.S. | 113 | 83 | 243 | 920 | 170 | 120 | 30 |
| Total | 4559 | 4867 | 5227 | 6475 | 9422 | 8374 | 1239 |
| Open manufacturing capacity | — | — | — | — | 150 | 1200 | 8300 |
| **Hydraulic turbines (5000 hp and up)—1000 hp** | | | | | | | |
| For continental U.S. utilities and industrials | 1373 | 2075 | 1734 | 2076 | 2429 | 685 | 960 |
| For outside continental U.S. | 246 | 330 | 207 | 356 | 214 | — | — |
| Total | 1619 | 2405 | 1941 | 2432 | 2643 | 685 | 960 |
| Open manufacturing capacity | — | — | — | — | 800 | 3600 | 3300 |
| **Steam generators (450 psig and up)—1,000,000 lb per hr** | | | | | | | |
| For continental U.S. utilities | 67.95 | 57.64 | 44.12 | 62.04 | 82.58 | 9.62 | — |
| For continental U.S. industrials | 20.70 | 11.57 | 10.33 | 21.70 | 9.25 | — | — |
| For outside continental U.S. | 5.92 | 4.75 | 6.64 | 16.12 | 3.55 | — | — |
| Total | 94.57 | 73.96 | 61.09 | 99.86 | 95.38 | 9.62 | — |
| Open manufacturing capacity | — | — | — | — | 50.00 | 140.0 | 150.0 |

# The New "RILEY 50" Pulverizer

Gives long uninterrupted operation, low maintenance and sustained fineness over years of operation.

Where the free moisture is evaporated—no capacity reduction with high moisture—where foreign materials in coal are rejected. This section reduces the coal going to main pulverizing section to at least 40% through 50-mesh screen.




We can merely touch on the many operating advantages of the new Riley "50" pulverizer in a two-page ad. The Riley "50" is the most significant pulverizer development in the past decade. Write for the story of the Riley "50." It will pay you to thoroughly investigate the Riley "50" before purchasing coal pulverizers.

TRADE MARK Rx REGISTERED

**RILEY**

**STOKER CORPORATION, WORCESTER, MASS.**

Boston New York Philadelphia Washington Buffalo Pittsburgh Cleveland Detroit Chicago
Cincinnati Atlanta New Orleans St. Louis Kansas City St. Paul Tulsa Houston Denver
Salt Lake City Los Angeles Portland Seattle

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS

# *Spontaneously* Accepted by Engineers

## Because of These Outstanding Features

*1 No capacity reduction with increase in moisture.

2 Tramp iron, iron pyrites and other foreign materials in coal rejected.

*3 Pulverizing elements faced with tungsten carbide.

4 Fineness sustained over years of operation.

5 Long periods of operation without necessity of shutdowns.

*6 Unusually high capacity per unit of space.

*7 Minimum foundation requirements.

*8 Ability to carry low loads.

9 Flexibility-wide load range.

*10 Operates without coal, with no noise and without wear or damage to parts.

11 Low maintenance and power.

*12 No explosion hazard, travel of coal through pulverizer faster than flame propagation.

*13 Quiet vibrationless operation.

*14 Ease of lighting and regulation.

15 High primary air temperatures.

16 Thoroughly dependable.

*17 Negligible cost of lubrication.

*18 All moving parts on a single horizontal shaft with bearings outside of housing. No worms or gears.

*19 Primary air fan integral with pulverizer —separate fan and motor not required.

**No other pulverizer can approach the Riley "50" in these important characteristics.*

***All of these companies have ordered Riley "50" Series pulverizers within the past year***

**Public Utilities**

*Monongahela Power Co.
*Iowa Electric Light & Power Co.
Utah Power & Light Co.
*Northern States Power Co.
*The Potomac Edison Co.
*Superior Water, Light & Power Co.
Central Ohio Light & Power Co.
*City of Owensboro, Ky.
City of Austin, Minn.
*Corn Belt Power Co-operative
*Public Service Co. of Colorado
Hartford Electric Light Co.

**Industrial Plants**

St. Croix Paper Co.
Hooker Electrochemical Co.
*Pittsburgh Plate Glass Co.
Celanese Corp. of America
United States Steel Co.
*Western Electric Co.
*Continental Can Co.
Monsanto Chemical Co.
Northern Paper Mills
Bell Aircraft Corp.
Syracuse University
Riegel Textile Corp.
Owens Corning Fibreglas Co.
*U.S. Finishing Co.
*Ciba States, Ltd.
*East Newark Realty
Lawless Brothers Paper Co.

**These companies have never previously used Riley pulverizers. The other companies have repeatedly ordered Riley pulverizers.*

**These contracts were engineered by the following consultants**

Bechtel Corporation
Ebasco Services
Chas. T. Main, Inc.
Pioneer Service & Engineering Co.
Sargent & Lundy
Sanderson & Porter
Stone & Webster Engineering Corp.
Black & Veatch
United Engineers & Constructors
Stanley Engineering Co.
Kenneth R. Warrington
J. V. Edesekuty
Francisco & Jacobus
Douglas M. McBean
Robson & Woese, Inc.

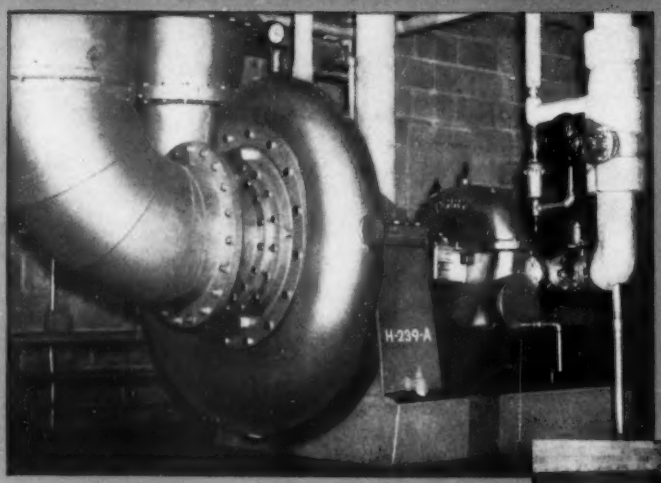
*A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power costs*

# COMPLETE STEAM GENERATING UNITS

. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

# "always glad to see you... but we seldom need help!"




CENTRIFUGAL

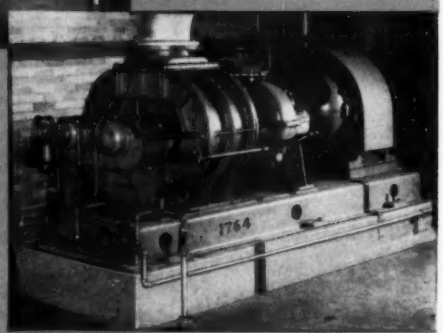
Type OIB Centrifugal Blower used for processing in a large eastern plant. Capacity 12,000 cfm. Similar R-C Blowers are utilized in other plants of this company.

The works manager of a large plant made this friendly statement to a Roots-Connersville representative. What he really meant was that R-C Blowers and related equipment perform so satisfactorily and dependably that they seldom need anything more than routine inspection by his own men.

In large and small plants, in every industry, R-C products uniformly give this kind of reliable operation. They continue to deliver rated capacities, year after year, with a minimum of maintenance—whether a small Rotary Positive Blower of 5 cfm capacity or a Centrifugal unit moving up to 100,000 cfm. And remember, only Roots-Connersville gives you this dual-choice.

If you are planning a new plant, expansion, or replacements, R-C engineers will work with you to select the equipment best fitted to your needs. Almost a century of experience is at your service.

ROOTS-CONNERSVILLE BLOWER CORPORATION
510 Powell Avenue, Connersville, Indiana




ROTARY

One of two Type RCDH Rotary Positive units in vacuum service in a power plant. Capacities 3,380 cfm. and 3,490 cfm., respectively.

ROOTS-CONNERSVILLE

BLOWER BUILDERS SINCE 1854

ONE OF THE DRESSER INDUSTRIES

**MAN OF ACTION Wayne Farrell ⬆ Briefs His Power Team to...**

# ...Keep Their Hawk-Eye Plant Modern, Shipshape

***Ever hear the expression, "Clean enough to eat your breakfast off the floor plates?" That's how spotless this Eastman Kodak plant is kept. "Good housekeeping and smooth-running equipment go hand in hand," says her chief engineer, Wayne Farrell. Here's how he does it . . .***

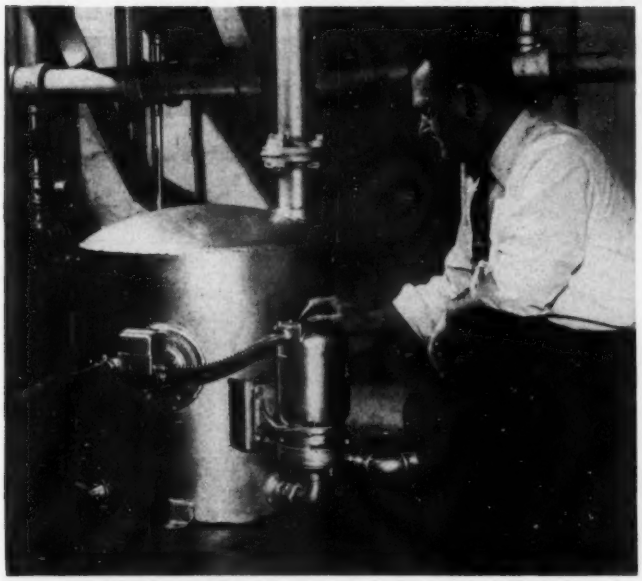
**DUST-TIGHT** stoker enclosures open easily for mechanical repairs. Here Farrell makes an inspection with Bill Bowden

**STEAM TRAP** overhaul is scheduled annual job. Farrell watches Maintenance Man Howard Killam take trap adrift. Workbenches spotted at handy places in plant. Tools, parts, fittings are stored in cabinets for easy access

**INSTRUMENTS** do away with guesswork. Farrell checks gas pressure for mixing machine. Plant uses large gas volume in "rare element" glass work for furnaces, annealing ovens; also in general production appliances

## EACH ASSISTANT KNOWS HIS JOB AND NAILS DOWN ANYTHING THAT...

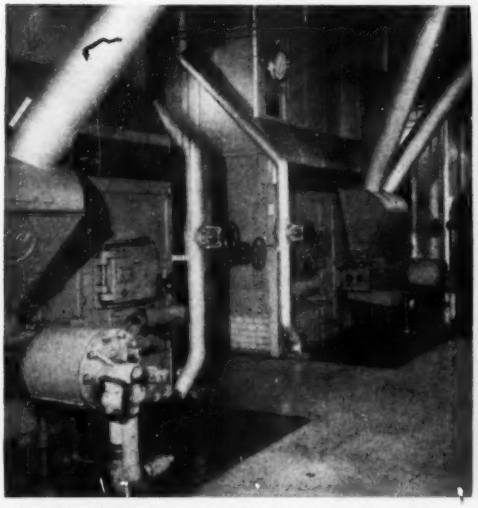
**PLUG HOLES—SAVE MONEY** Stoker hopper seam calked by Maintenance Man John Keppler. Says Farrell, "To maintain a clean plant we calk seams, seal all air leaks in stokers, boilers. This also improves efficiency by stopping excess-air intake into boiler." Making rounds with calking gun is routine. Leaks aren't given a chance—they're stopped fast. Clean, light boiler room builds morale, makes working at Hawk-Eye pleasant



**SALVAGE WATER PUMP** installed by Farrell saved its own cost. Before that, water not used for boiler makeup went down the drain. Now excess overflows into pump's tank and is lifted automatically to cooling towers to make up evaporation losses. How's this for a spotless corner?

**SAFETY** isn't an accident at Hawkeye. Only low voltage used inside boiler drums. Labeled equipment cuts down mistakes, builds safety habits

## ...LOOKS LIKE TROUBLE BEFORE IT HAS A CHANCE TO GROW BIGGER



**BOILER ROOM** sparkles like this all the time. After 11 years steady operation, it's still tops. "Cleanliness, safety and peak operating efficiency all tie together," says Wayne Farrell. How's this for being shipshape?

**ASH REMOVAL** is modern vacuum system. It cuts down dust and dirt that usually team up with this job. Ashes go direct to silo over coal dump. Then same truck delivering coal to plant carries away a load of ashes


CONTINUED ON NEXT PAGE

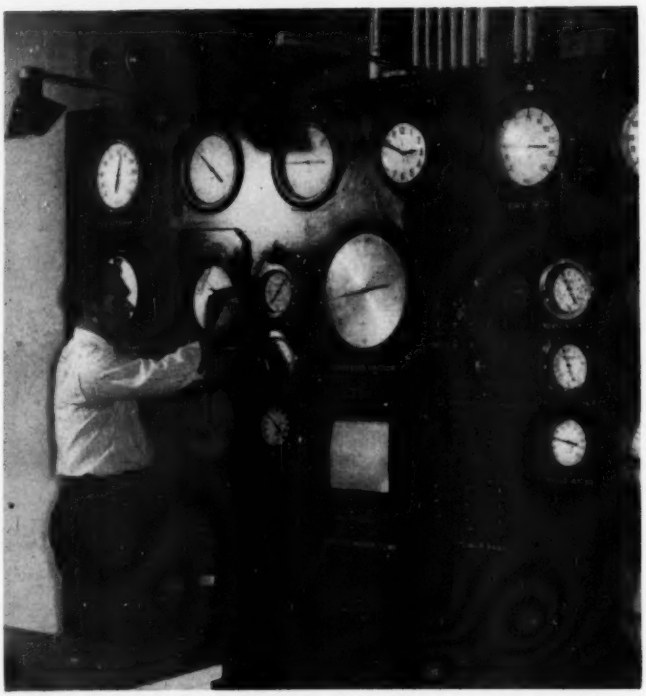
## THERE'S A PLACE FOR EVERYTHING AND THE RIGHT EQUIPMENT FOR...

### CONFERENCE

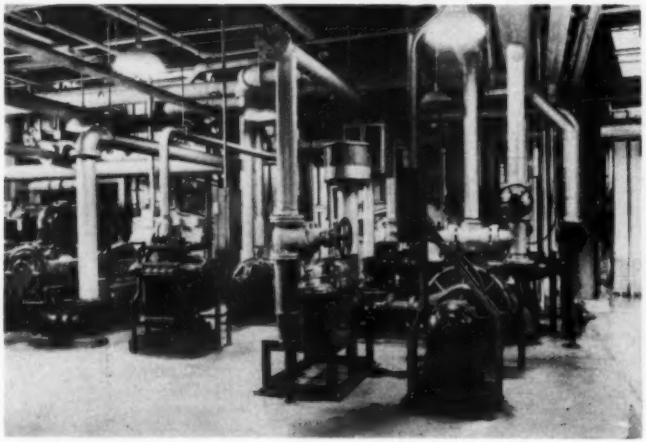
Wayne Farrell, chief operating engineer at Hawk-Eye, starts each day in a conference with his assistants. From left to right, Howard Killam, Walter Guite, Farrell, Bill Frobel and Raymond Vanderzell.

Here Farrell inspects power and refrigeration logs of the previous day. He notes reports of leaks, faulty action of equipment and checks repairs.

He then makes out work slips from the log reports and assigns jobs to the engineers and maintenance men on duty. That's one reason this plant sparkles and that's why Hawk-Eye has an envied reputation.



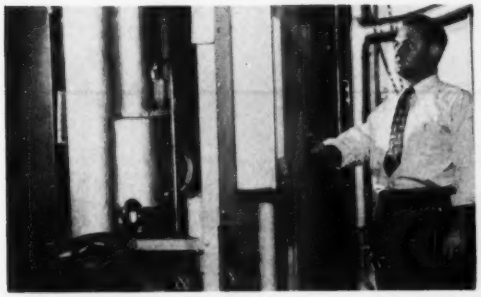
**REFRIGERATION CONTROLS** is last word for large 2000-ton refrigeration and air-conditioning system. Annunciator system indicates trouble source, signals with warning horn. Farrell makes sure all meters and controls are checked at set periods, work right. Board glistens



**ENGINE ROOM** at Hawk-Eye is well lighted, clean. Plenty of room around equipment to service right. This view shows only one section, but note dry floor with no leaks at all. Color scheme is light to enable maintenance crew to track down trouble. Open machine bases are rigid and kept free of dirt

**CHEMICAL DRUMS** are no eyesore. Cabinet front removable to roll drums in, out. Howard Killam measures boiler chemical

## ...EACH JOB. TIME SAVED IN BREAKDOWNS IS SPENT IN CLEANING



**TESTING** emergency power and all other emergency equipment is Farrell's weekly routine. Generator supplies immediate power for controls and lighting if regular supply fails. Besides shining, machine is raring to start

**BOILER WATER** checked carefully for needed treatment. Farrell says, "Modern plant needs complete water-testing equipment. Boilers too vital to take chances." All readings carefully logged; treatment's right

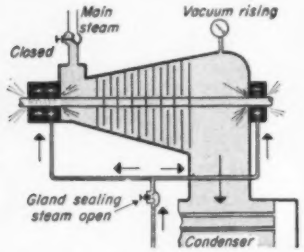
**NIGHT PROFESSOR** Farrell instructs students in control-panel operation. He teaches two nights a week. And he's educational chairman, past-pres, NAPE, Rochester. This is Rochester Inst of Tech power station

**CLEAN INSIDE AND OUT,** this big Eastman Kodak modern Hawk-eye plant. It's on the scenic gorge of Genesee River, Rochester. Plant manufactures Kodak's "rare element" glass, lenses, optical goods and other apparatus. Power plant you have been peeking into through these pages is located at extreme left. It's here that Wayne Farrell, the lad who started out as glass blower back in 1928, keeps the power services flowing

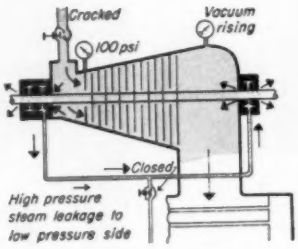
OPERATORS' NOTEBOOK 44

# Fix Those Seals

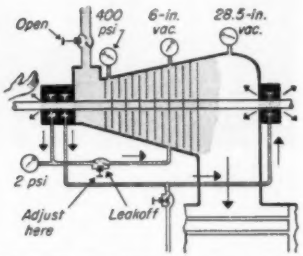
## HOW GLANDS WORK




**TO START,** open gland steam. Steam blowing: out around shaft, seals it; through turbine, is condensed by cooling water

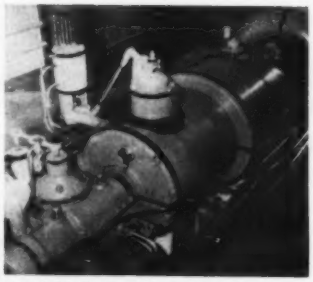



**WITH MAIN STEAM CRACKED,** leakage past shaft blows back in sealing line to end. No sealing steam needed.

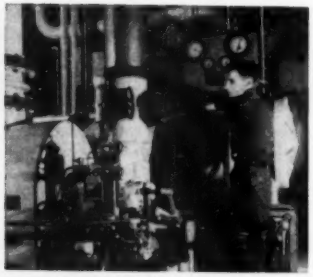



**WITH FULL PRESSURE** on turbine chest, more steam's at hp end than needed. Excess leakage helps l-p turbine stages

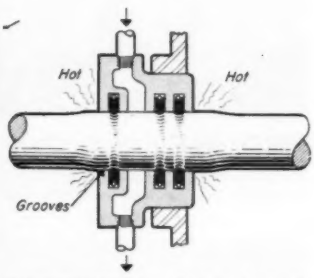
## GLAND TROUBLES AND CURES



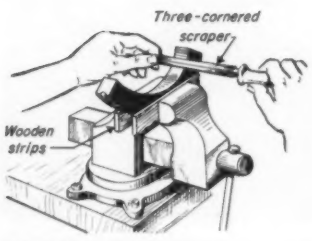
**TURBINE VIBRATES** and screeches when carbon sealing steam pressure's too low. Then rings ride shaft; hug, overheat it



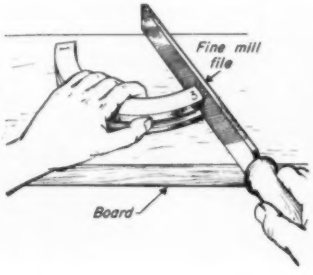
**GIVE FULL STEAM BLAST** to carbon rings to 'lubricate' shaft and lift rings. If vibration doesn't stop, slow turbine fast



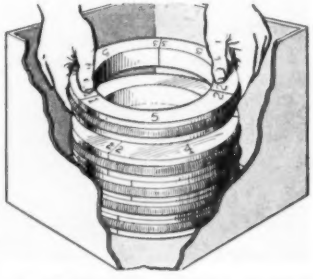

**SHAFT EXPANDS** from friction when sealing steam fails. Carbon rings wear grooves fast and shaft glows with heat




**PLACE EACH SEGMENT** in vise between wood strips. With 3-cornered scraper, carefully remove shiny inside surface



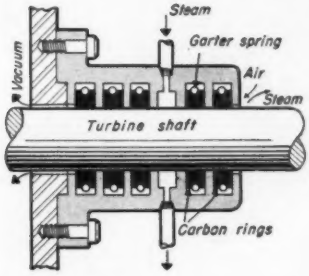

**FILE** from one end of each segment with fine mill file until assembled ring has 0.001 in. clearance, for each in. shaft dia



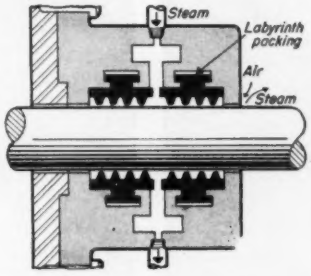
**PLACE RINGS** in box, exactly as they were in gland (on big job). Ring sides are also sealing joints; watch assembly

# Before They Knock Out Turbine

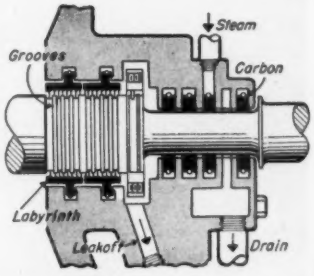
BY STEVE ELONKA, *Associate Editor*



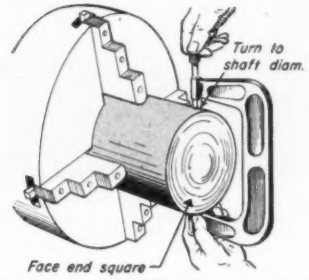

**CARBON RINGS** in gland restrict steam leakage out and air leakage in. Rings are in segments, held by garter springs




**LABYRINTH GLAND** has soft white-metal segments in dovetailed grooves around shaft. These restrict leakage at shaft

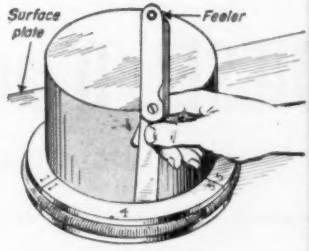



**COMBINATION** labyrinth with leakoff, plus steam-sealed carbon-ring gland. Grooves at labyrinth break steam path.

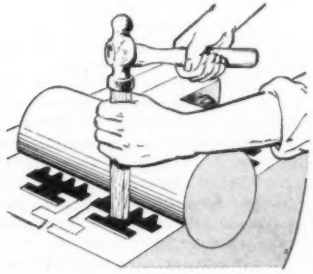



**OVERHAUL CARBON RINGS** at set periods. First step is to mike turbine shaft and turn short casting to exact shaft dia

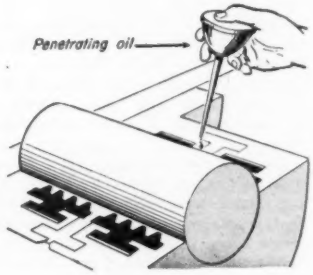
**REMOVE RING SEGMENTS** from gland. Segments are numbered at each end and each segment has a number. Watch this



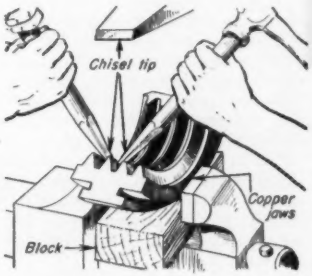

**LAY SQUARE END** of casting on surface plate. Assemble one carbon ring against it, and check clearance with feeler gage



**REMOVE LABYRINTH SEGMENTS** for inspection by light taps against wood strips. If they do not slide out easily, stop




**RUST** in gland housing often holds labyrinth segments. Fill dovetail slot with penetrating oil and let set overnight

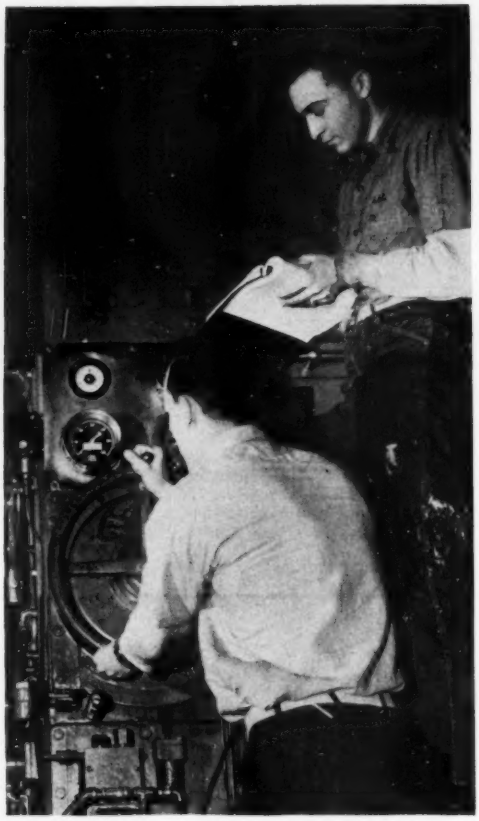



**REST SEGMENT** in vise on wooden block. Upset sealing edges with flat-tipped chisels so metal almost touches shaft

**RIGHT ANSWERS** are important, whether diesel is large, or small one shown. Here's handy repair rack for small job

# DIESEL Q and A

By **JOHN BAKER**, *Chief Engineer*



**OPERATING DATA** are jotted down by cadet midshipmen at Merchant Marine Academy diesel lab for study in classroom

**Q 1—Why should the doors of a diesel-engine crankcase never, NEVER be opened after shutdown, until the engine has cooled?**

**A**—In a totally enclosed diesel crankcase, air and oil vapor mixture is very rich. If the engine has a "hot spot," such as an overheated bearing or bushing, piston or any other part, with temperature high enough to form a seizure, there's danger of a crankcase explosion. Only reason there's no explosion before door is removed is because there's not enough air to mix with oil vapors.

But if crankcase door is opened while engine is still hot, fresh air rushing in through doors supplies needed oxygen for explosion. If operator removes door, he stands in direct line of blast and can be fatally hurt.

**Q 2—Explain how to find cause if your diesel engine stops suddenly.**

**A**—First check fuel-oil supply. Next check whether fuel system is airbound. Fuel filter might be plugged or fuel lines broken. Then check fuel system from oil-supply tank to strainer.

Check day tank for water in fuel. Do this by opening drain cock. If there is water, and drain valve is not large enough, remove valve bonnet from suction line to drain tank quickly, when engine is needed badly. But take precautions for fire hazard. Next check transfer pump. The valves, springs, gaskets, plunger, roller or guide may be at fault.

Diesel piston may have seized from poor lubrication. Check by trying to jack engine over. Remove piston and replace with new if it's badly scored. In severe cases, liner may have to be removed and piston jacked out. Be sure to change lube oil before starting engine with new piston and rings. Also clean oil pan, lines and filter.

If you find none of these conditions, engine may have stopped from bearing seizure. If bearing is not badly wiped, scrape enough to clean it up. If it is badly wiped, replace with new unit.

Or the engine's fuel-pump driving chain may be broken (if it has one). Then engine will have to be retimed.

On some engines the fuel pump's adjustable coupling can slip if not tightened properly. Check this.

**Q 3—What is best way to start a diesel engine in extremely cold weather?**

**A**—For quick starting, heat circulating water and lube oil to about 110 F. Then circulate through engine until it is warm. Some installations have permanent connection from hot-water line to cooling water for this purpose.

Or place resistor-type electric heater and fan in diesel's air intake. Heat air so it is warm for engine starting. Some engines have air pre-heater, "flame thrower" for cold-weather starting.

If compression on engine is poor from worn piston rings and liners, lift cylinder heads and smear heavy grease around top of pistons. This helps seal compression for those all-important revolutions before engine starts firing.

If engine burns heavy oil, run on kerosene for a few revolutions before shutting down, until heavy oil is cleaned out. After engine starts on kerosene next time, switch back to heavy oil.

**Q 4—What is meant by compression ignition, and what pressures are needed for diesels?**

**A**—Ignition in a diesel engine is caused by the heat of compression. This is done by the piston drawing outside air into the cylinder on the downstroke, and compressing it on the upstroke. Oil injected into the hot compressed air ignites without a spark, open flame or a hot bulb.

Pressures of 375 to 400 psi are enough for medium- and large-size cylinders with open combustion chambers. With engines using precombustion chambers, pressures around 450 to 560 psi are needed.

Reason for higher pressures on separate combustion-chamber-type engines is that the ratio of cooling surface to combustion space volume is greater. Then cooling effect of greater area must be overcome with higher pressures. Higher temperatures are also needed in small, high-speed engines where the fuel must be burned in a shorter time.

**Q 5—How is fuel oil tested for carbon residue, and what effect does carbon have on the engine?**

**A**—Fuel oil is tested for carbon residue by the Conradson test. This test is made by burning oil with a limited amount of air. Then carbon formed is measured.

Oil forming over 3% carbon causes rapid cylinder wear. A good distillate oil should run below 0.5% carbon content. Some residual oils form as much as 14% carbon.

**Q 6—Many engines have valve seat inserts and valve stem guide inserts. Explain how inserts are renewed.**

**A**—Inserts for valve seats are made of nickel, cast iron, stellite, copper-tungsten, or cast aluminum-bronze. These inserts are pressed or shrunk into valve cages or into cylinder heads.

Valve stem guide insert is either a bushing or sleeve made of close-grained cast iron. This is a drive fit into the valve stem guide of the valve cage. Because bushing is soft cast iron, it takes most of the wear caused by valve stem's up-and-down motion.

Valve-seat inserts are removed with a narrow-pointed cape chisel. First the insert is cut, then pried apart over its seat with the chisel. But take care not to harm the seat. Valve-stem inserts are removed by turning the valve cage bottom up. Then remove valve and stem, drive insert or bushing out with brass stock.

**Q 7—What effect will a cocked connecting rod have on the engine, and when is a connecting rod said to be in alignment?**

**A**—A cocked rod may make the piston operate in such a way that the piston ring faces are not parallel to the cylinder wall. Under such conditions, upper and lower portions of the ring face are worn away on opposite sides, but not the middle portion. This makes it impossible for one half of the ring to scrape oil on its downward stroke. Also, misalignment places a high load not only on the piston and cylinder wall, but also on the connecting rod bearing.

A connecting rod is in alignment when its piston's sliding surface is exactly at right angles or square with the connecting rod. This is checked by placing this rod vertically on a surface plate, so rod rests on machined bearing cap's surface. Then insert the wrist pin in the upper bearing and measure distance from surface plate to both ends of wrist pin with a surface gage, inside calipers or inside micrometer. If distance is same on both sides, rod is OK.

**Q 8—What is a "jerk-pump" fuel-oil system for diesel engines?**

**A**—Pump-injection system, sometimes called "jerk-pump" system, has an individual pump or cylinder pump serving each cylinder, and connected directly to the fuel nozzle.

The pump meters the oil charge and controls injection timing. Nozzle contains a valve, which opens when injection pressure is reached and closes when pump delivery ceases. Most of these systems contain a cam-operated pump, connected by a tube to the fuel nozzle.

**Q 9—What would you look for if the backpressure on your engine was excessive?**

**A**—First inspect the exhaust piping, mufflers and waste-heat boilers for flow restrictions, such as carbon deposits. Check for pulsations that might cause backflow of exhaust gas. Pulsations may be from faulty exhaust system.

**Q 10—Give some general hints to follow before overhauling an engine.**

**A**—Before overhauling an engine, it's good practice to observe it in operation. Watch cooling water and lube oil pressures, valve mechanism and governor operation.

If practical, indicate the engine and study cards for compression and combustion pressures, also for unusual signs. Listen for abnormal noises and note any condition that's not right.

When tearing down the engine, do it in an orderly manner by marking all mating parts not already marked. Place the large parts on boards to prevent marring them. Place smaller parts in boxes to prevent loss. First clean all parts with Stoddard solvent.

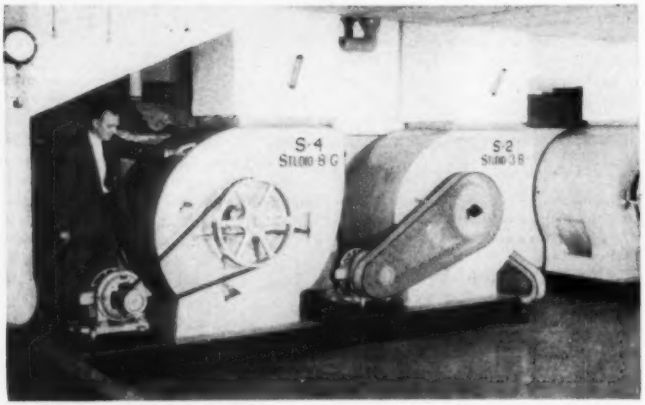
Try to work out repair schedules so only one cylinder is completely overhauled at a time. This has advantage of localizing to one cylinder running faults caused by overhaul. If entire engine is torn down, it's sometimes hard to find minor adjustment faults because everything worked on must be checked on all cylinders.

**Q 11—Explain where heat generated in a diesel and in a gas engine goes.**

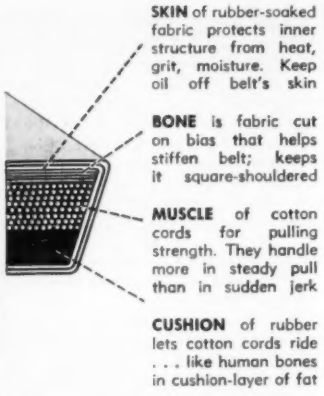
**A**—*Diesel:* 34% for useful work. This is just another way of saying that 34% is the thermal efficiency. And 30% is jacket loss. It represents heat absorbed from pistons and cylinder walls by water in surrounding jackets. 27% is exhaust and radiation loss. This is amount of heat carried away in hot exhaust gas and heat radiated from engine and exhaust piping. 9% goes to friction loss and includes friction of crankshaft and connecting-rod, pistons, etc. This friction goes to heat and adds to other losses.

*Gas engine:* 25% is useful work; 30% is jacket loss; 38% exhaust and radiation loss; 7% friction loss.

**LARGEST** centrifugally cast cast-iron piston ring is 29 in. dia for Tacubaya diesel plant. Double Seal Ring Co claims centrifugal casting makes this iron ring about twice as strong as static casting



**V-BELTS MAKE SWEET MUSIC?** Above vent equipment for RCA studios must hold air conditions constant to keep the orchestra's instruments in tune when "on the air"


**SKIN** of rubber-soaked fabric protects inner structure from heat, grit, moisture. Keep oil off belt's skin
**BONE** is fabric cut on bias that helps stiffen belt; keeps it square-shouldered
**MUSCLE** of cotton cords for pulling strength. They handle more in steady pull than in sudden jerk
**CUSHION** of rubber lets cotton cords ride . . . like human bones in cushion-layer of fat

**V-BELT ANATOMY** compares with man's. Bending will bulge muscle in both cases

# Stretching V-Belt Life

***First understand the following few rules on selecting and operating V-belts. Then link these hints with those on p 121 in June 1951 Power and you've the whole story. All info from Allis-Chalmers***

► V-BELTS CALL FOR little attention and maintenance. But there are simple precautions you should have at your fingertips that extend their life span. And the single most important fact to understand is just how a V-belt works.

**V-Belt Grip.** A flat belt depends on frictional contact for its grip, a chain drive on sprockets, a gear on teeth. But a V-belt produces its own grip. To understand this, take a V-belt in hand and bend it. You will see its V-angled sides bulge. Then let it straighten out and the bulge will disappear.

In real life the sheave does the bending (sheaves are the spool-shaped, grooved, driving and driven units around which the V-belt travels). Sides are straight when belt travels in a straight line between sheaves. But soon as she rides into the groove of a sheave and starts bending, the belt sides will try to bulge. And in trying to bulge you get a high-pressure contact between belt sides and groove walls.

**Crack-the-Whip.** Ever play crack-the-whip as a kid? Chances are you ate supper off the mantel till you realized the tremendous snapping force a whipping action can produce. And if your V-belt drive hasn't enough tension you'll get the same snapping action. This will probably happen at peak loads or when starting the motor. Any extra slack is suddenly taken up, and the last section of V-belt to be whipped taut is jerked with a force far greater than it was designed to stand. This explains why a loose V-belt will stretch more in service than a tight one.

So don't be afraid to pull V-belts tight. Stretching them slightly is good for their general health. How tight? See p 120, June 1951, POWER. Check often for stretch and sag, especially during the break-in period. *A slack V-belt feels dead when you thump it with your hand; a properly taut V-belt has an alive springiness.*

And while you're worrying about tension, check sheave alignment occasionally. A straightedge will do or, in a pinch, a cord. Just stretch it across the sheave faces and see that it touches at all four possible points of contact.

**Life Expectancy.** Belt life is largely determined when the drive is laid out. So let's say a few words about tailoring a V-belt to the drive.

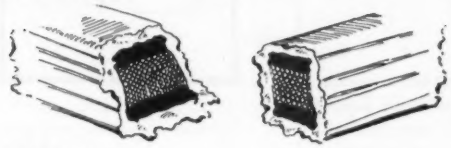
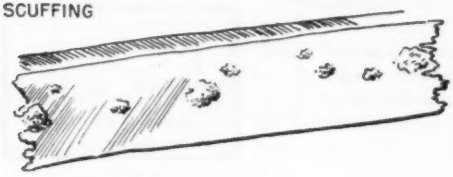
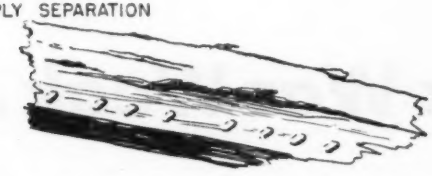
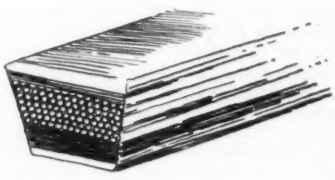
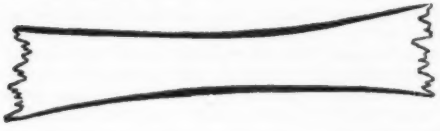
Every V-belt has an "easy arc" depending on the thickness of its cross section. Bend it more sharply (for instance, around a sheave that's too small in diameter) and you're in for trouble. How? Well, the internal friction of excess flexing will cook the life out of the belt in double-quick time.

Here's a tip on center distances. Short centers mean less belt to stretch. And this means there's less possible stretch to cause slippage and crack-the-whip action. Smart planning calls for short-center drives. Remember, too, that short centers save valuable floor space.

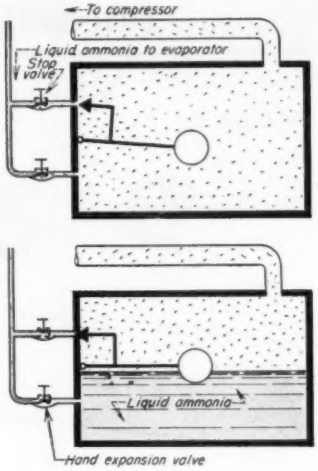
While the number and size of V-belts help determine the drive's capacity, they do not tell the whole story. Speed counts, too. It's the old story of horsepower depending on torque (twisting power) and rpm. Therefore, a given number of belts can transmit more hp if larger sheaves are used. To put it another way, the power that can be transmitted by a given belt is proportional to the belt speed (within practical speed limits.)

**TROUBLE CHART** shows cause of belt failure and how to prevent. Read causes, cures now . . . then spot-check on your V-belts

# POST-MORTEMS TEACH MAINTENANCE LESSONS

| INJURY | CAUSE | PREVENTION |
|---|---|---|
| SNUB BREAK  | **TWO SIGNS** show this broken V-belt is victim of crack-the-whip: (1) cover wear means lots of slip. (2) fairly clean break suggests sudden snap. Belt was probably slipping, suddenly grabbed | **KEEP** all V-belts properly taut. Test for excessive slack (see text on facing page). Or test for slip by comparing speed ratio of sheaves between no load and full load. Allowable variation: one half of one percent |
| SCUFFING  | **BOLTS** protruding inside guard did damage here. Such scuffing can exert enough "braking" to cause a sudden snap. That happened here | **WHEN** placing guards or steelwork near drives, figure on some stretch and sag. Leave enough clearance so V-belts can sag a bit without disastrous results |
| PLY SEPARATION  | **SPLIT** along pitch line shows V-belt was run over a too-small sheave. Too much bending caused excessive internal friction, baking life out of rubber binder that holds pulling cords together | **WITH** every V-belt size goes a minimum sheave diameter. Any saving in sheave cost by ignoring manufacturers' recommendations is more than paid for in more frequent V-belt replacement |
| SLIP BURNS | **BELT** too loose to pull its load. While belt stood motionless, frictional contact with spinning-driving sheave melted its rubber. When the belt did grab, it snapped | **SEE** first item, *above*. Of course load may have been too great. If tension in drive is proper, and sheave grooves and V-belts free of oil or grease yet slip persists—check unit for increased load |
| OIL FAILURE | **V-BELT** drove threading machine that used cutting oil. After only one year of operation, oil made rubber soft and lifeless—no longer of support to cord and fabric | **SPLASH** guards provide some protection against oils or greases. But where considerable oil reaches V-belts, special oil-resisting V-belts of synthetic rubber may be the best answer |
| ABRASION  | **ABRASIVE** dust wore sidewalls, narrowing belt width. Belt then rode on bottom of groove, slipped, lost its proper shape as well as its size | **WHEN** V-belt drives are in dusty places, dust guards provide protection. Because slip contributes to abrasive action, proper tension is doubly needed in dusty spots |
| BROKEN CORDS  | **INNER CORDS** were broken when belt was pried over sheave flange on installation. (Cover, being bias-cut fabric, stretches without breaking.) Such breaks can be caused also by pieces of wood or metal falling into groove | **NEVER PRY** new belts into grooves, nor "ring" them from one groove to next. Motor should be loosened and moved forward. Every drive should have a takeup for the proper installation and adjustment of belts |

## RIGHT . . . level controls expansion




Float-expansion valve should be installed like this. Both the stop valve (which shuts off the liquid ammonia to the evaporator) and the auxiliary hand-expansion valve are closed. When the compressor is run, all the ammonia can be pumped out. Then the ball-float will hang up at its lowest point, while the expansion valve that it controls is held wide open.

When stop valve is opened, ammonia expands into the vessel. Some ammonia evaporates, or is evaporated by the sweet water it cools in a shell-and-tube tank, not shown here. Ammonia accumulates, raising ball-float until it closes valve to outlet. This float regulates ammonia level automatically and there is no need to open hand-expansion valve.

# Why Soft Drink Was Weak...

***. . . until O L Brage of Oroville, Wash. was called in on the job. One Sunday he turned to and took the cooler apart. Then he saw how the float-controlled expansion valves fouled up the works***

► CARBONATED WATER contains sweetening and carbon dioxide. In one bottling works, it could have been mixed with ammonia. Had matters gotten much worse, it *would* have contained ammonia. Come to think of it, maybe it did.

Our carbonated water had a stronger charge of carbon dioxide than most similar drinks. To absorb this charge, the water had to be cold enough, around 38 F. The problem lay in getting it that cold.

**Trouble.** Once the run of bottles was started, the water temperature began to rise, like the cost of living index: 39 F, 40 F, 41 F, 42 F, 43 F, etc. At 44 F the operating engineer, with tears in his eyes, would stop the run and begin a haphazard adjustment of valves to eliminate the trouble. For if bottled at 44 F, the drink would have about as much bite as a toothless person eating corn on the cob.

The root of the trouble ran back into the past, like halitosis, alimony and in-law fights. Long before my first grandson got married this plant had put in a new cooler plus a 6 x 6-in. ammonia compressor. The cooler was a large-capacity vessel with a float-in-head low-side expansion valve, see illustrations. From the start, this vessel had not worked right. Someone had got the idea that a hand-expansion valve around the float was the answer.

**What's Wrong?** Note this setup, for it's important, and see if you can spot the trouble from the following data.

The system gave trouble from the date of installation. When starting the compressor, the system pumped down to a vacuum. The vacuum held even after the king valve at the liquid receiver was opened. No matter what else was done, the system would not produce enough refrigeration to cool a caribou's heels until the bypass around the expansion valve was opened.

For days without end, the refrigeration system would hold the soft-drink temperature close to the needed 38 F. And then only by keeping the hand-expansion valve well opened and the suction pressure low.

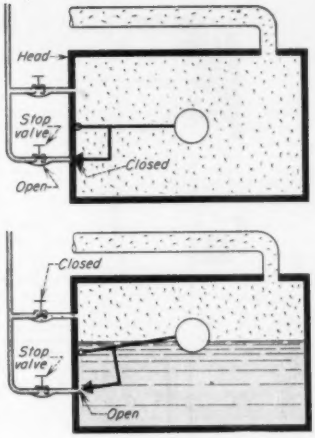
If the bottle run had to be stopped for any reason while the refrigeration system operated, trouble rose swiftly. Frosting back from the water cooler to the compressor would begin. And it could not be stopped by tightly closing the hand-expansion valve and keeping it closed. First the king valve had to be closed for a time. And just as soon as the bottle run was resumed, the water temperature began to rise. Then the drink got weak again!

Or for no reason anyone could think of, the system worked perfectly for several months. It worked well, in fact, until the operator noticed that no liquid ammonia showed in the receiver's gage glass. He then gave her an extra charge.

**System Charged.** After she was charged, the frosting back became much worse. And the water's temperature rose much faster. "How come?" engineer and maintenance mechanics asked each other. "Why did more ammonia produce less refrigeration? With frost around both cylinders, down on the crankcase and creeping up on the water jacket, why did the compressor get colder and colder, while the water for the soft drink got warmer and warmer?

Above all, why did the addition of apparently much needed ammonia interrupt the longest period of trouble-free operation the system had gone through?

# WRONG . . . ball keeps expansion closed




With head upside down and stop valve open *or* closed, ball's weight kept expansion valve closed—no ammonia entered. No refrigeration unless hand-expansion valve was opened.

With hand-expansion valve cracked, ammonia going into vessel was evaporated by water being cooled for soft drink—no harm. But if bottling stopped, or valve opened, liquid ammonia collected in vessel pushed float higher. Float opened needle valve—with stop valve open, more liquid poured in, raising float still higher. Even with hand-expansion valve closed, float-controlled valve stayed open—let all system's ammonia into cooler. System worked right only when there was just enough ammonia to operate with.

"Overcharge?" "Huh?" "With a low-side float?" "*Nuts!*"

Despite the fact that there was no high-side pressure rise to indicate an overcharge, the maintenance mechanic suggested a larger liquid receiver. The old one could not possibly hold the full charge of ammonia during a pumpdown.

How I got drawn into the mess, I don't now remember. Possibly because, as Mortimer Snerd says, I had relatives in Washington. After hearing the case history of the weak carbonated water, I suggested that we look into the cooler. We took a Sunday afternoon and four of us removed the cooler head for a look.

**The Answer.** If you haven't nailed down the cause of our trouble, here it is: The cooler head was turned halfway around, thus turning the low-side float upside down. The float's weight pushed needle into its seat, thus closing valve.

Whatever liquid ammonia lay in the vessel evaporated, and the system pumped down. When the hand-expansion valve was opened, the system worked well until a bottle run was halted, or further opening the expansion valve let the liquid ammonia rise to the float. But that didn't help.

This rising liquid, instead of closing the needle valve, as would occur in normal operation, opened it wider and wider, and never allowed it to close until the hand-operated king valve shut off the liquid at the receiver. During the time the system operated perfectly, the system's ammonia charge was just right to hold the float up. And the valve was open just enough to prevent flooding over to the compressor.

So what? If your system doesn't work right, don't nurse it along year after year. Tear it apart and look inside. That's cheaper than poor operation.

## DID YOU KNOW?

. . . that one common refrigeration headache is from moisture in system? Besides causing corrosion, it results in a "freeze-up." That takes place when the moisture freezes around expansion valve, blocking some or all refrigeration flow.

. . . that one drop of water in a one-half-ton Freon-12 system can completely block the expansion valve? Reason is expansion needle valve has only average opening area of 1/32-in. diameter during normal operation, while a drop of water is about 3/16-in. diameter.

. . . that if one drop of water in system won't completely block the tiny opening around expansion valve, it often freezes to the seat or needle, preventing valve from closing on OFF cycle. Then system "acts up" and operator is in for a merry goose chase, trying to find what is wrong with system.

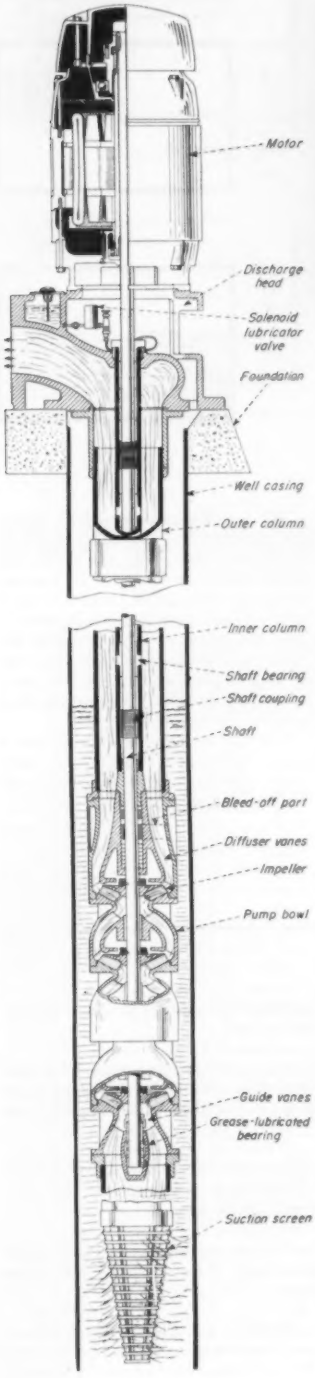
. . . that four common methods are used for removing moisture from refrigeration systems? They are: (1) heat and vacuum method (2) hot air method (3) double evacuation method and (4) $CO_2$ and alcohol method.

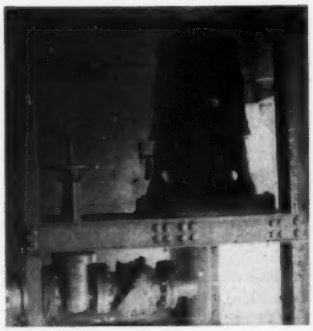
. . . that it doesn't pay to reactivate a drier taken from your system? Reason is that oil film collected by absorption agent bakes on while being dried out. Then drier cannot absorb more moisture.

. . . that refrigeration piping should not be installed directly on soft coal cinders? When these cinders get wet, they give off sulfur dioxide gas and destroy piping.

. . . that wood should not be next to refrigeration floor piping? Wood rots from pipe moisture. Then wood releases tannic acid and corrodes pipes.

. . . that air in system displaces gas. Indications of air are similar to those of ammonia shortage, except condenser pressure is much higher. Keep air purged, add needed ammonia.



**WELL PUMP,** vertical-turbine type, is installed indoors on steel framework

**OUTER COLUMN** of 300-ft-deep well was neglected; corroded and parted at bowl

# Smart Maintenance Keeps Wells on the Job

***Here's what gives you that all-important water for plant operation. String along with John B Murphy to get the low-down on well and pump troubles, their causes and cures. He rounds out the know-how that started on page 74, this issue***

► YOU MAY RUN INTO two major troubles with a well—loss of capacity or a pump that misbehaves in one way or another. Either trouble can be serious enough to put you behind the eight ball where water is concerned. To make things easy we'll stick to well troubles on this page, pump troubles on next three.

**Spot Well Trouble.** If static water level in well stays about the same but pumping level falls off, you can be fairly certain the well is to blame. Easiest way to cure the trouble is to find it and go to work pronto. If you can't do the job yourself, call in someone who can. Don't waste time—you may regret it.

Clogged or corroded intake screen is most common cause of capacity falloff. Minerals in water may deposit on screen or there may be an organic growth that plugs screen openings. Worse yet, pumping at too high rates may have pulled a large amount of sand into the screen, developed area or gravel pack. In rock wells mineral deposits or organic growths can give trouble. Or well may partly fill with sediment that closes off some water passages. In certain sections of the country your casing rusts fast, pushing capacity down.

**Cure Trouble.** You can often remove mineral deposits from screen by chemical treatment. Acid or Calgon, alone or together, may cure balky wells. Screens aren't damaged by inhibited acid, but if they are badly corroded it's best to replace them with new ones.

Never try to salvage a well without expert advice. You can spend a lot of money on the job and not get much in return unless you do it right and use proper materials. So you'll know what to expect when salvaging a well, we'll quickly run over some methods.

In acid cleaning, inhibited muriatic acid is poured into the well to fill the space around the screen. Well is then capped for 8 to 12 hours. Water in well

**FOUR-STAGE** motor-driven vertical turbine pump of oil-lubricated enclosed-shaft type. Solenoid-controlled oiler feeds lubricant to the bearings in inner column

## TURBINE WELL PUMPS ACT UP? USE THIS CHECK CHART TO FIND TROUBLE CAUSE, CURE

| SYMPTOM | CAUSE OF TROUBLE; REMEDY |
|---|---|
| PUMP WON'T START | 1 IMPELLERS LOCKED. Sand causes many locks. Try raising and lowering impellers by adjusting nut. This may free them. If it doesn't, backwash with clear water. Or try turning shaft at top with small pipe wrench. Be careful—you may damage shaft. If you can't free impellers, pull pump and tear down bowl assembly to get at rotating parts<br>2 TRASH IN CASING. Rags, wood or metal jammed in pump may prevent turning. Tear down pump and remove. Fit with a suction strainer to keep trash out<br>3 CORROSION OR GROWTHS. Pumps that are out of service for long periods may be locked tight. Use acid or Calgon to remove corroded matter or growths<br>4 PACKING TIGHT. Adjust so there's enough leakage for shaft cooling and lubrication<br>5 TOO MUCH BEARING FRICTION. Use right oil; consult builder for viscosity range. Oil bearings before starting. Check tube tension nut for tightness. See if shaft is bent; replace if needed. Check anchoring of pump head to see it hasn't caused bending and distortion of pump. Return bent shafts and columns to factory for new ones. See that water-lubricated rubber bearings are wet and sand-free. Wrong tension on shaft-enclosing tube of oil-lube pumps may throw bearings out of line. If well is so crooked that it causes misalignment, have it reamed to larger diameter or put in smaller pump<br>6 MOTOR OR WIRING FAULTY. Check circuit breaker or fuses for open line. If starter overload relays have tripped, reset. Disconnect motor from pump and see if it starts. If it doesn't, have a manufacturer's engineer look it over. Check motor wiring against wiring diagram for pump<br>7 IMPELLERS NOT ADJUSTED PROPERLY. Set them high enough so there's room for shaft stretch caused by hydraulic thrust. Adjustment should allow shaft to turn freely; then stretch caused by rotor and shaft weight won't bind pump<br>8 WELL CAVE-IN. You need otuside help to repair a collapsed well |
| PUMP DOESN'T DELIVER WATER | 1 WRONG ROTATION. Change rotation of motor. With a 3-phase motor, just switch any two power leads<br>2 SPEED TOO LOW. Check voltage and frequency of power supply. See if excessive bearing friction, corrosion or obstruction of impeller slows pump. Check gear ratio and motor speed if pump is being operated for first time. Look over belt-driven units for slippage or wrong pulley size<br>3 PUMP NOT PRIMED. Vent well to atmosphere so there isn't a vacuum at pump suction. All impellers of vertical turbine pumps must be under water because these units won't start discharging against a suction lift. A 4 to 10 ft net positive suction head is needed for good operation. Have enough head on pump to allow it to discharge at rated capacity<br>4 FAILURE OF PUMP PARTS. Look for broken shaft, broken bowl assembly and loose column-pipe joints. Tighten all impellers<br>5 PUMPING HEAD TOO GREAT. See that discharge valves are open and that check valves don't stick. If water table has fallen, suction lift may be too large. Or discharge resistance may have increased to too high a value. Increase size of discharge line or reduce discharge pressure. If this doesn't help, you may have to install a new pump with a greater head<br>6 CLOGGED SUCTION. Clear clogged suction pipe, strainer or impeller by backwashing. If well screen is plugged, you probably need help from an experienced well driller<br>7 WELL OVERPUMPED. With excessive drawdown the pump may break suction, fail to deliver water. Reduce pump capacity by throttling discharge |

| SYMPTOM | CAUSE OF TROUBLE; REMEDY |
|---|---|
| PUMP USES TOO MUCH POWER | 1 PUMP NOT RIGHT FOR JOB. Study performance curves. If power demand can't be reduced a larger motor may have to be installed. You can reduce impeller diameter to cut input hp; head and capacity go down too. Reducing speed of belt- or gear-driven pumps has same effect. If pump has been incorrectly selected for job it may have to be changed for one with right head, capacity<br>2 OVERSPEEDING. Check for high frequency, voltage. See that pulley sizes and gear ratios are right<br>3 WRONG LUBRICANT. See that you have enough of right oil where needed. Check motor bearings for oil or grease quantity and type. Be careful with water-lubricated bearings. You may need an air-relief valve in column to allow water to enter bearings<br>4 TIGHT PACKING. Adjust so there's enough leakage for shaft lubrication<br>5 IMPELLER RUB. See item 7 under "Pump Won't Start"<br>6 WRONG ROTATION. Change two power leads of 3-phase motors<br>7 OTHER CAUSES. Look for misalignment, bearings that are too tight or vibration in pump or piping. Check for excessive discharge pressure |
| PUMP CAPACITY LOW | 1 LOW PUMPING WATER LEVEL IN WELL. Vent well. Check pump inlet for excessive turbulence, vortexing or eddies. Liquid velocity entering pump must be that recommended by manufacturer and submergence sufficient. See item 3 under "Pump Doesn't Deliver Water." Check bowls, well screen for sand, rust or bacterial blocking<br>2 IMPELLER WEAR. Metal loss from outer tips of impeller vanes pushes capacity down. Loss at inner or suction end hasn't much effect. If fully enclosed impellers have usual wearing rings, trouble may be in them. Look for excessive clearance. With semi-open impellers that don't have bottom shroud or wearing rings, you need close-running clearance at bottom of vanes<br>3 FAULTY INSTRUMENTS. Make sure that your water-level reading is right. See that flowmeters for measuring pump capacity read correctly. Check pump pressure gage<br>4 HEAD ON PUMP TOO GREAT. As you increase head on a pump its output falls off. Look for plugged pipes, closed valves or other obstructions that may increase head<br>5 LEAKS. Openings in pipe at flanged or threaded joints can cause loss of water. Same is true for gaskets and packing. See that there aren't any holes in bowl, column pipe or pump head<br>6 SPEED LOW. Check as given above |
| TOO MUCH VIBRATION | 1 BEARING TROUBLES. Check your lubricating oil or grease for grade and quantity. Look for too much sand in water. See that pump is aligned properly<br>2 ROUGH OPERATION. Check to see that impeller and bowl passages are free of wood, rags, sand and other material that might throw pump out of balance. Also check driving motor by disconnecting from pump and running alone. Look for too much wear in rotating parts<br>3 PUMP TAKING AIR. Check on water velocity at pump inlet. See if there are leaks in well vent. Find if suction head on pump is sufficient. Overpumping a well so pumping water level is intermittently drawn down may cause pump to "grab air" and is a common source of severe vibration |

is surged gently with a plunger, by pouring more water into it, by using solid carbon dioxide (dry ice), or by capping and forcing compressed air into well at a moderate pressure. After gentle surging well is again capped for 2 to 4 hours. This is followed by violent surging. Sulfuric acid may be used with muriatic to dissolve minerals that have collected on screen.

With Calgon, well is taken out of service for 24 to 48 hours. Charge of about 16 lb of it for 1000 gal of water in well is put into casing, in solution. If there's bacterial growth, enough calcium or sodium hypochlorite is added to disinfect well. The pump is started and stopped to surge well about 12 times every four hours for 24 to 48 hr. When finished, well is flushed to waste until water clears up. On many jobs this is enough to restore original well capacity, increase pressure and reduce drawdown.

No matter what salvage method you use, be sure to get competent advice before spending any money. You can waste plenty if you don't.

**Pumps.** Table, above, gives low-down on well-pump troubles, causes and cures. On the next two pages are sketches showing how to do many parts of job.

For more on wells and pumps turn page

## TRY THESE MAINTENANCE HINTS

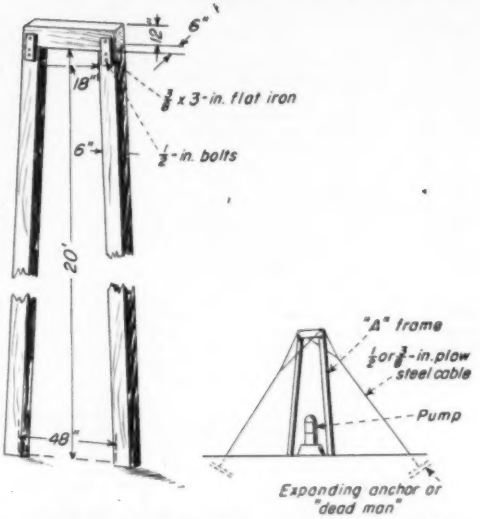
(*Well and pump maintenance begins on p* 120)

Sketches, *this and next page*, give you a quick look at typical jobs you meet in well and pump maintenance. They're handy to have for study before or during every new job. Here are some extra pointers:

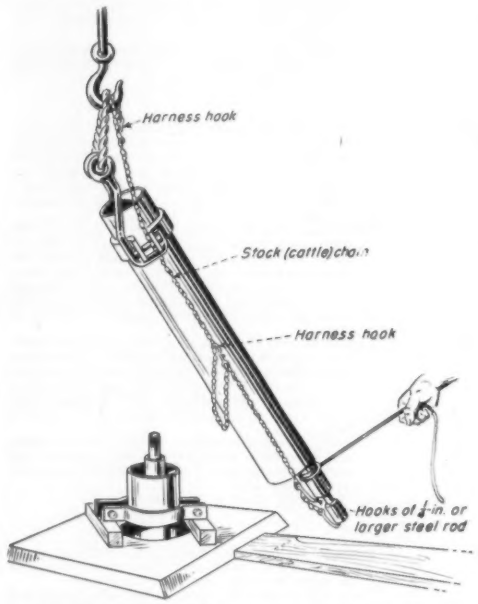
Tearing down a well pump is heavy work. So equipment you select to lift parts must be strong enough to safely support them. Wooden "A" frame, column clamp and sling, and other rigs shown are safe for all usual jobs. But if ever in doubt see an engineer who knows well and pump maintenance.

POWER's Data Sheet, No. 230, p 150, this issue, tells you how to test pumps. Use it and the check chart, p 121, for sure-fire results in your plant.

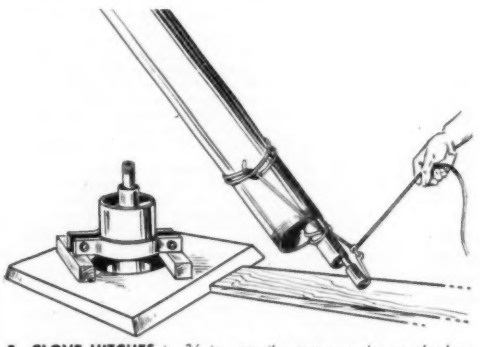
# USE THE RIGHT METHODS AND



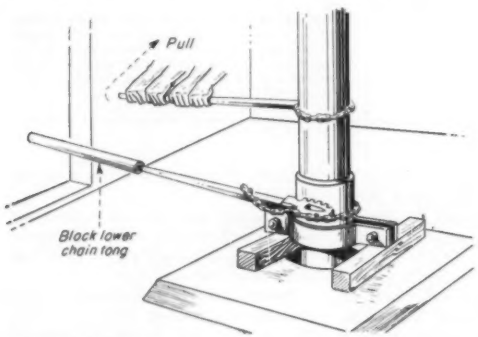

**1** **"A" FRAME** safely handles 5 tons when guyed or blocked properly. Use when lifting pump head, column sections



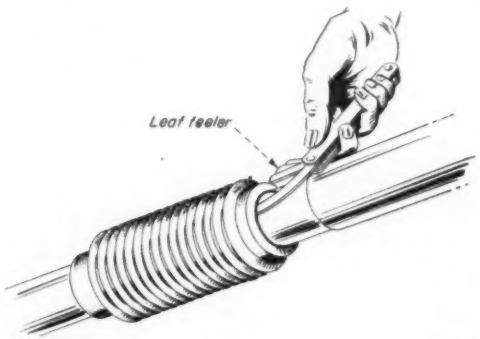

**3** **TAILING OUT** a column section using the column clamp and sling shown in Fig. 5. Have sling strong enough for load



**4** **CLOVE HITCHES** in ⅜-in. manila rope can be used when hooks and chains aren't on hand for tailing out or in

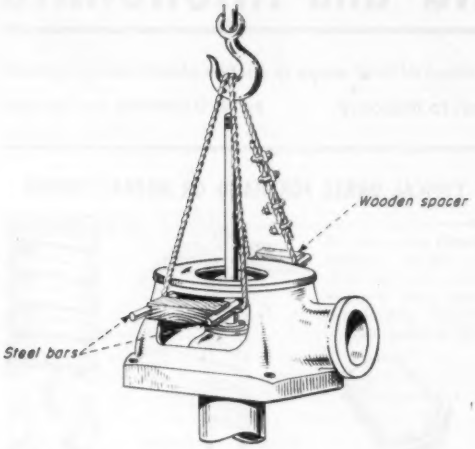



**7** **USE CHAIN TONG** to make up outer column. Have two men pull up as tight as possible on 4-6 ft leverage to assemble

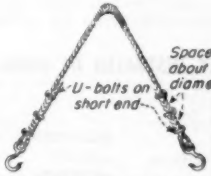



**8** **MEASURE** clearance between worn shaft and bearing. Slide bearing to unworn section; measure. Difference is wear

# TOOLS TO MAKE WELL AND PUMP MAINTENANCE EASIER, SAFER, SURER



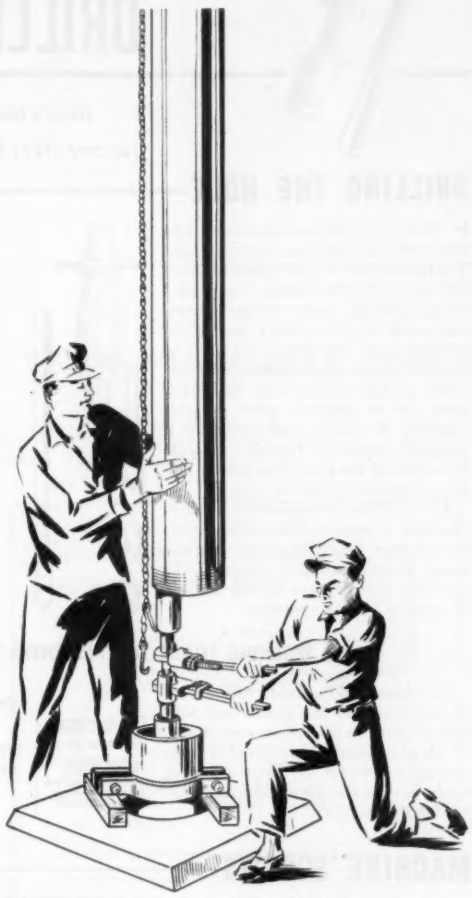

**2** **USE SLING** to lift pump head after motor removal. This is the heaviest lift you make, so be careful with job



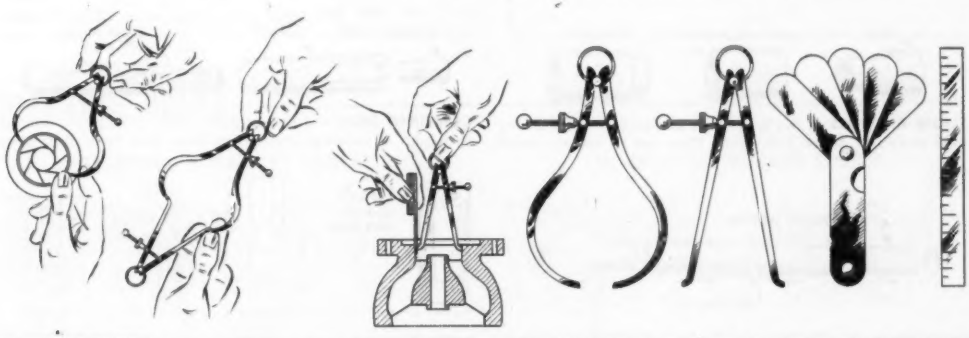

SAFE NUMBER OF CLIPS

| Rope dia, in. | No. of clips |
|---|---|
| 7/16 to 3/8 | 3 |
| 3/4 to 1 | 4 |

**5** **COLUMN CLAMP** and sling. Many drillers use patented "elevators" for this job. *Right:* safe number of Crosby chips



**6** **ASSEMBLE** shaft by butting ends firmly but lightly in the coupling, using small wrenches. Don't pull hard on them



**9** **WEARING-RING** wear measurements are easy to make when you have the right tools and know how to use them. Inside and outside calipers are used on impeller wearing rings, inside calipers and leaf feelers for bowl. Use light touch on work

## Today's Tools for . . .

# DRILLING and ANCHORING

***Here's the lineup of best ways to fasten electrical equipment (or any other kind) to masonry***

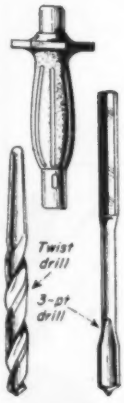
By JIM O'CONNOR, *Associate Editor*

## DRILLING THE HOLE

► MOST ANCHORING-TO-MASONRY jobs start with drilling the right-size hole. Then the anchor of your choice is forced into that hole. Next, anchor is expanded either with the fastener itself (screw, bolt, nail, etc) or with a special expanding tool. This bulges the sides of the anchor against the hole.

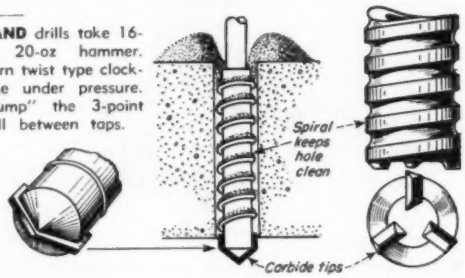
All anchors shown here will do a good job in masonry *when properly installed*. No anchor will hold well if installed carelessly. Trouble can come from drilling the wrong-size hole or failing to expand the anchor properly.

Use drill size recommended by manufacturer of anchor. Make hole slightly deeper than length of shield. Greater depth increases holding power of the masonry. Hole depth is more important if masonry surface crumbles.




### TYPICAL DRILLS FOR HAND OR ROTARY POWER

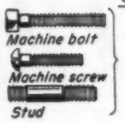
**HAND** drills take 16- to 20-oz hammer. Turn twist type clockwise under pressure. "Jump" the 3-point drill between taps.




**ROTARY POWER** bits fit regular electric drills. Normal speeds, about 1200 rpm, are OK on holes to ½-in. dia. Try lower speed on larger holes. The drills shown above clean hole as they work. Hollow-center rotary drills are available to cut up to 6-in. dia

### SAFE WORKING LOADS FOR FASTENERS PROPERLY INSTALLED IN GOOD MASONRY

Use these working loads with a dash of common sense. An anchor will hold only as much as the masonry can stand. Think of machine bolts, threaded studs and lag screws for the heavy vibrating loads. Reserve the screw and nail fasteners for lighter work.




| Safe load, lbs | Size |
|---|---|
| 100 to 5400 | 6/32" to 1 1/2" dia |

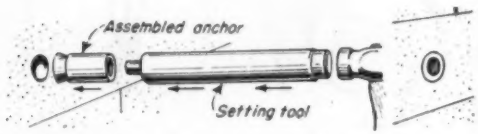
| Safe load, lbs | Size |
|---|---|
| 50 to 525 | 1/4" to 3/4" |
| 30 to 600 | #6 to #24 |
| 60 to 600 | 3/16" x 7/8" to 1/2" x 3 1/2" |

## MACHINE SCREWS

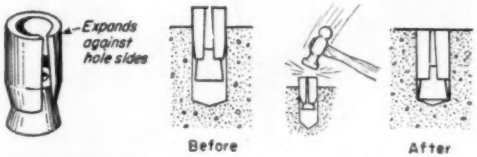
**Big difference in these anchors is the method of installation: One combines drill and anchor, another eliminates calking tool**

**SCREW ANCHORS** of this type range in size from those taking 8-32 screws to jumbo 1-in. units. They can be set any depth

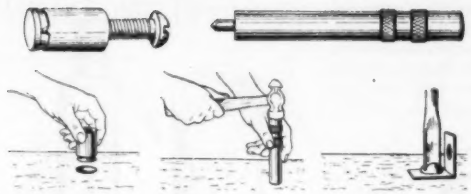
**COMBINED DRILL** and anchor shell. After drilling hole remove shell, slip in expander plug. Then drive shell home over plug



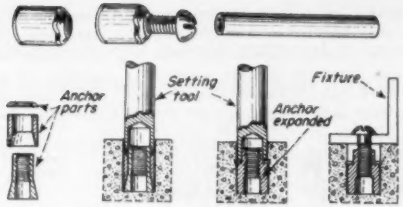

**TO INSTALL,** first slip unit into drilled hole. Then expand sleeve with setting tool. This drives sleeve over tapered nut




**YOUR HAMMER** is calking tool here. No need for a bottom contact, hence well suited for hard surfaces with soft backing



**RUSTPROOF-METAL** threaded cone hugs lead sleeve. Closed cone bottom keeps dusts out of the threads, important in floor work

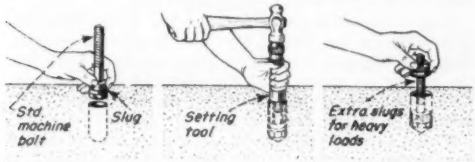



**TESTS ON THIS TYPE** reveal no need for larger than ¼-in. size in baked brick; mfr claims brick will go before anchor

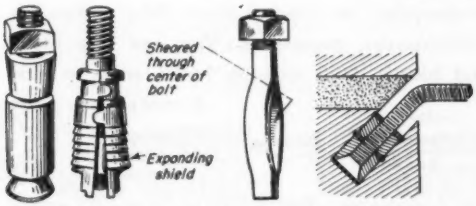
## THREADED STUDS

Keep threaded studs in mind when installing safety switches, panelboards or meter pans. You can mark drill points on the wall right from the mounting holes in the box or from a template. With studs in and box ready to position, you may find one stud out of line. This can be handled simply by forcing stud back into line with the expanding tool.

**FOR HEAVY LOADS,** poor masonry, try two or more lead-alloy sleeves. Calk each sleeve separately, as they're installed



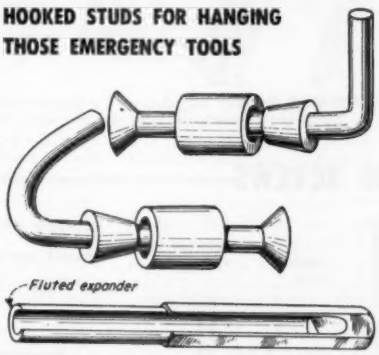

**LEAD RINGS** slipped between layers of hard metal make up the expanders in this type. You can use standard machine bolts head down in the masonry




**SHEARED-BOLT** type, *right*, drives home like a nail; hammer won't hurt threads

**TRY THIS** when lined-up with poor mortar

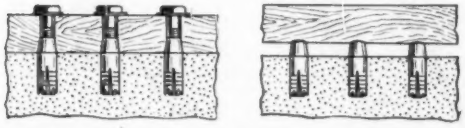
### HOOKED STUDS FOR HANGING THOSE EMERGENCY TOOLS




**THESE WERE ORIGINALLY** designed to fasten wire-mesh to masonry before "gunning on" new concrete. But you can use them in ¼-in. size for hanging your tools

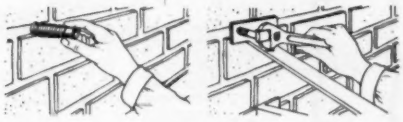
## MACHINE BOLTS

### FASTENING TIMBER TO CONCRETE



**DRILL-ANCHOR** combination unit (see facing page) well suited for timber jobs. Let anchors stick out; mark and drill timber

### IN BRICK OR MORTAR SEAMS?

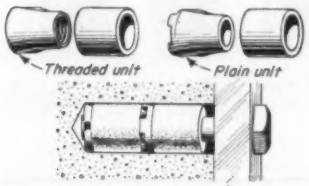


**WHERE POSSIBLE** set anchors in solid brick rather than mortar seams. Where you can't, drill holes and set anchors deep

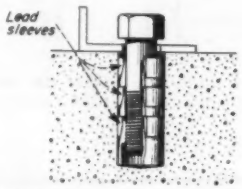


*More on next page*

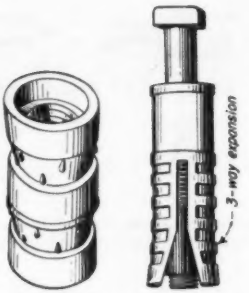
Machine bolts have several advantages over threaded studs for floor work. First, they give a more finished look to the job. But what's more important, they often make it easier to install the equipment. How? Well, let's say you're installing a row of machines on a concrete floor. If you use threaded studs, you'll have to jockey each machine up to clear the studs. Not so with machine bolts. Here you insert bolt after machine has been slipped into position.




**THREADED UNIT** expanded on bottom. The plain unit that follows is also expanded




**THIS ANCHOR** builds up from series of separate units installed independently




**BOTH ANCHORS** built for similiar jobs: Sectional unit, *left*, has false bottom to keep dust from threads. Shield type, *right*, expands 3 ways as bolt tightens

## LAG SCREWS

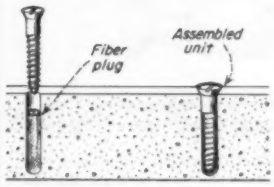
**TYPICAL METALLIC SHIELDS** for lag screws. Tightening the lag screw into the shield expands its sides against walls of hole

Lag screws by themselves are often used to fasten motor bases to overhead wooden beams. When used in masonry, a metal shield is first placed in the drilled hole.

Many construction electricians use lag screws when running heavy conduit (about 3-in. and larger) on masonry. When tackling such a job figure about one strap every 5 ft. Lay out the run with a chalk line. Mark off for each strap. Then let your electrical apprentice loose with a drill and a pocketful of shields.

When all shields are in place, swing one section of conduit into position at a time. As you make up each coupling, set the straps and tighten the lag screws.

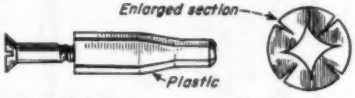
## WOOD SCREWS




**FIBER PLUG** has metal core. Hole, plug and screw all have about same diameter

**Handy plugs for everyday use around plant. They're fine for small conduit, switchboxes, panelettes. You can buy plugs in fiber, lead and plastic. Drill so plug forces snug in hole**

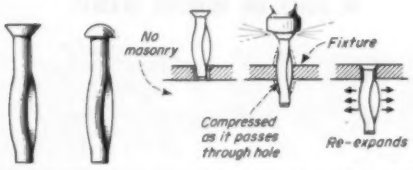
**LEAD PLUG** is designed so wood screw cuts its own threads as shield expands




**PLASTIC PLUG** can be used with wood or sheetmetal screws, or with plain nails

## NAILS

### ONE-PIECE COMBINATION FASTENER AND ANCHOR




**SHEARED ROD** is preexpanded; drives like nail in drilled hole. It compresses to fit the hole, then holds like bolt

**DOUBLE-HEAD NAILS,** *right*, do well if fixture isn't permanent

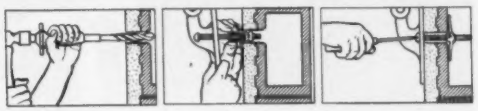
### HOOK-NAIL IN ONE UNIT

**THIS HOOK** is mighty handy for fastening guy-wires in masonry

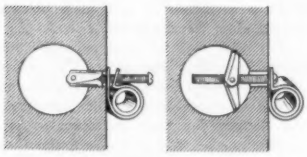
# TOGGLE BOLTS

**Fastening to any hollow material is usually best handled with a toggle bolt: here's how**

**MANY TYPES** are available but all use same basic principle. Support furnished by two legs that spring against inner wall



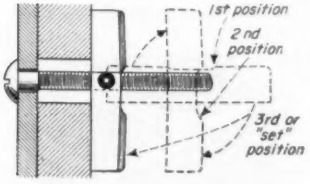
**DRILL HOLE** through shell large enough to pass toggle legs. Put bolt in fixture, then squeeze legs; shove in drilled hole



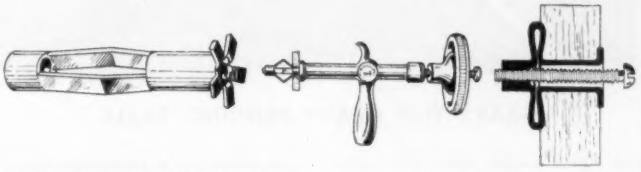
**NOTE HOW** spring legs expand once they are free in hollow tile; tighten to set

## SEVERAL TOGGLE BOLTS THAT ARE OFF THE BEATEN PATH

**FOR METAL TOO THIN TO TAP,** simply push these ready-made tapped units into a plain round hole. Note that screw is held so it can't vibrate and loosen. Drag is controlled by the hole diameter




**GRAVITY** controls position of this type. Tightened toggle hugs inner-wall surface

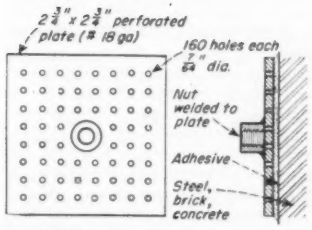


**TOGGLE-SCREW ANCHORS** for fastening to wallboard, sheetmetal, thin panels, hollow gypsum, metal lath, or wooden lath. First, hole is drilled and anchor slipped in place. Then a special tool, *above center*, sets toggle by "reaching" in and pulling the threaded portion toward front. Remove tool and insert screw

Fastening light conduit runs and splice boxes on hollow masonry is best done with toggle bolts. But where you want to fasten a distribution panel that weighs about 150 lb, think in terms of $\frac{3}{8}$-in. bolts. Run these bolts clear through the hollow wall and right through a backup cross-plate. The cross-plate can be a piece of 1 x 3-in. hardwood or a piece of 3/16-in. steel stock.

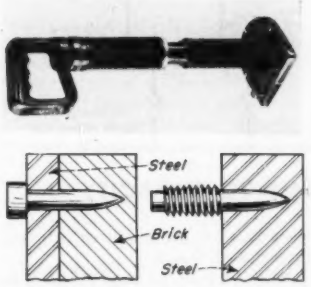
Holding strength of the masonry is especially important where you're using toggle bolts. If you think distance between outer wall and inner shell is too little, make a test installation. And when you use toggle bolts make sure both toggle legs are open and resting solid on the inner surface.

## FASTENING WITH ADHESIVE



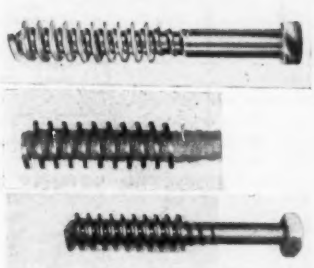

**ADHESIVE BOND** between wall and anchor-plate is important feature of this type. Will hold on brick, steel, or concrete. When installed, surface must be dry and free from grease. Firmly bonded paint needn't be removed. Holds 10 lb safely

## USING A POWDER CHARGE



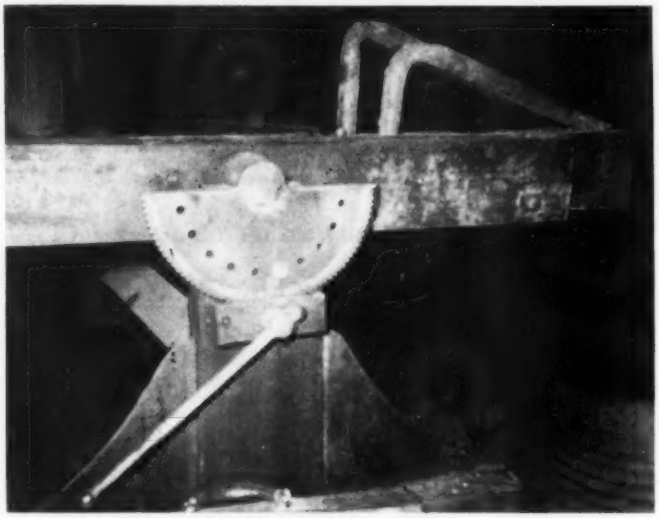

**HAND TOOL** holds a charge and fastener. Force tool against surface, push plunger. Powder charge goes off, setting fastener

## BEFORE POURING CONCRETE



**SCREW ANCHOR** is helical coil. It fits around screw before concrete is poured. Screw removable after the concrete sets

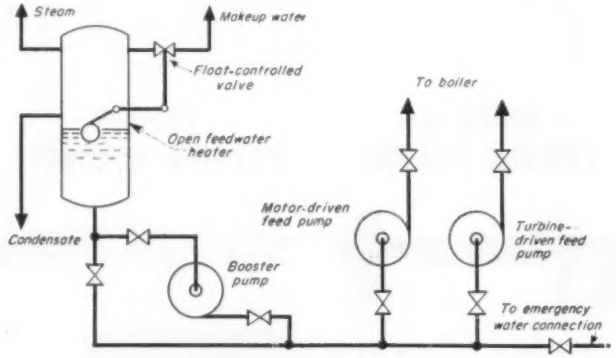
# PRACTICAL IDEAS... *here's the trading post for your*



## GEARS TILT HEAVY BENDING TABLE

THE HEAVY bending and welding table in our plant is supported by a stub shaft resting on a pedestal at each side of the table. This table was not easy to position and hold in place. To solve this problem, one of our machinists welded a half gear to one of the shafts as is shown in the photograph above. A pinion on an old vise worm meshes with the gear. The vise handle easily tilts the table to any one of ten positions. It is then held there by a bolt through the gear and bearing pedestal.

OLIN L BRAGE *Oroville, Wash.*




## BOOSTER BRINGS PUMP TO CAPACITY

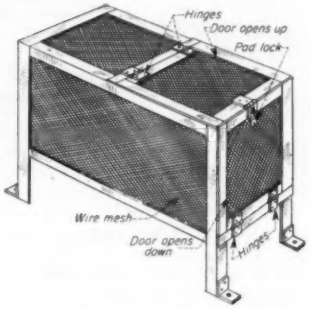
WHEN WE started our plant it had one 55,000 lb-per-hr boiler operating at 400-psi, and supplied by two 130-gpm feed pumps. These pumps were connected as shown without the booster pump. At that time the steam load was about 22,000 lb per hr with either pump supplying the boiler.

When the load increased to 30,000 lb per hr one pump could not hold water level in the boiler. As each pump was rated 130 gpm it should have been able to supply twice the boiler load. The pumps were opened and inspected without finding anything wrong.

We then got their specifications from the manufacturer and found that a 19-ft positive-suction head was required. We had only a 10-ft head and pipe friction reduced this to 7.5 ft. Since the pressure could not be increased in the open heater, and we could not raise the heater without shutting down the plant longer than a weekend we put in a booster pump as in the diagram.

For this we used an old 150-gpm, 75-ft head unit. This pump was larger than we needed but it was available and solved our problem. After installing the booster the load increased to 57,000 lb per hr, but a single boiler-feed pump could hold water level in the boiler. The booster was connected as shown, so that it could be cut out when not needed on low loads.

SERGIO MARTINEZ JR *Havana, Cuba*




## Guard Makes Machine Safe

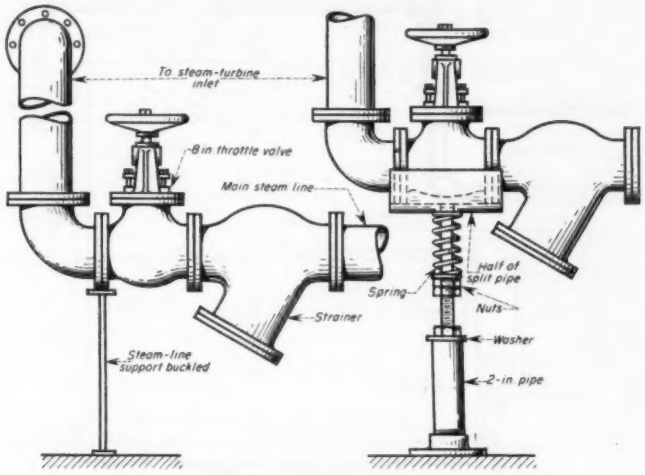
AN OLD-TYPE MOTOR and belt-driven centrifuge in our plant was ruled a hazard by the accident inspector. To completely enclose the machine and motor in a cubicle required a lot of reconstruction so we gave up this idea.

Accident inspector ruled, if machine could be enclosed to cover running parts, it would meet safety regulations.

To do this we made the guard in the drawings from angle iron and wire screen. The angles are 1½x1½ in., welded at the corners. Sides are enclosed with heavy wire mesh down to 6 in. below the lowest moving part.

To service the motor and machine two doors are in one end of the guard as shown. One of the doors opens up, and the other down. They are kept padlocked except when an authorized mechanic works on the machine.

HOWARD T LIVINGSTON *Los Angeles*



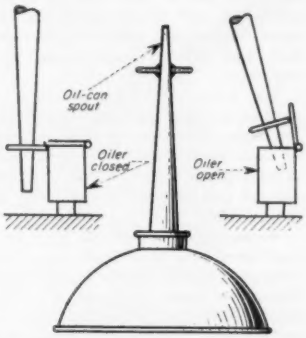

## SPRING CURES PIPE-EXPANSION TROUBLE

To SUPPORT the main steam line to our 5000-kw turbine we made a simple structure from ½-in. steel plate, left-hand figure. Everything in this pipeline was apparently correct. It had a 10-in. expansion joint, supported at its center, but we forgot about expansion of the vertical pipe to the turbine. After initial operation, we noticed that expansion of this line had bent the steel support under the elbow.

This experience showed that the support must have some give and take, so we built the one in the right-hand drawing. A section of 2-in. pipe threaded into a flange forms the base. A 1¼-in. rod with a long thread goes down into the pipe. Top end of the rod enters a clearance hole through a section of extra-heavy pipe resting against valve flanges.

The 1¼-in. rod goes down into the 2-in. pipe so its top end just enters the hole in the pipe section. The rod is held in this position by the bottom nut. The other two nuts are then screwed up against the heavy spring to get a good tension and locked there. Any downward thrust of the steam line is taken on the spring, the end of the support going up into the pipe section. This change cured the expansion trouble.

G AMADOR DE LOS RIOS *Havana*




## Washer on Oilcan Spout Simplifies Reaching Oiler

BY BRAZING A WASHER on our oilcan spouts we can easily reach oiler in out-of-the-way places. The drawing shows the washer brazed about ⅝ in. from end of spout. With the washer the oiler's cap can be lifted and the spout put in, as shown above. This works well when we oil bearings in narrow places.

Since putting washers on our oilcan spouts we notice that out-of-the-way bearings are better oiled. It is always easy to overlook a hard-to-get-at bearing even when the oiler knows where it is.

STANLEY R WELLING *Racine, Wis.*

## Uneven Cutoff Caused Faulty Engine Operation

WHEN I took charge of a plant, a 150-hp corliss engine belted to an alternator did not respond to the governor. At about one-half load there would be a wave in the slack strand of the belt. This would cause the belt to slip, stopped only by belt dressing.

As an indicator was not at hand, I took the bonnets off the valves. They were a little out of adjustment, which I corrected. But this fault was not enough to cause the trouble.

Next I removed the cylinder head and found the piston rod a small amount off center and the cylinder walls slightly scored. These, however, did not add up to a cause of the trouble. I centered the rod in the cylinder and treated the cylinder with oil and graphite.

After blocking the governor in mid-position I found that it tripped the valve at one-third stroke at the crank end and one-tenth stroke at the head end. With the governor still in mid-position I adjusted the reach rod until the valves tripped at about 20% stroke at each end.

When the engine was put back in service, the belt did not wave and slip. The engine easily carried full load and there was a marked saving in fuel for firing the boiler.

A G WIGGINS *Cleveland, O.*

## Deposits on Engine Valve Shut Down the Plant

ONE NIGHT one of three poppet-valve uniflow engines driving dc generators slowed down and stopped during peak load. The other two units could not take the extra load so the plant was shut down. All units were again started including the one that failed and they picked up the load. The engine that caused the trouble took its share of the load but had a knock in one end of its cylinder.

As soon as the load could be handled by the other two units, the faulty engine was shut down. We took the bolts out of valve housing and tried to lift it as a unit, but the lower part of the valve disk would not come past its seat. We then took the housing apart leaving the valve and its stem in place. The valve was found badly scaled with what appeared to be carbonized oil. This scale, about 3/32 in. thick, had also formed on the valve cavity and adjacent surfaces.

Apparently the shutdown was caused

(More PRACTICAL IDEAS on page 130)

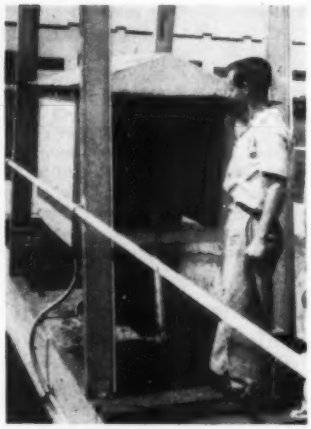
Begins on page 128

by a piece of this scale getting between the valve and its seat. This let steam enter both ends of the cylinder at the same time. Equal steam pressure on both ends of the piston stopped the engine.

The valve and valve cavity were cleaned and the parts assembled. When the engine went into service, it caused no more trouble. To make sure everything was in order we removed and cleaned the valve on the other end of the cylinder.

We figured that engine oil had at one time been used to lubricate the valve stem parts within the housing. Some of this oil had worked down into the valve cavity. This oil, not being suited to high-temperature steam, carbonized and formed the deposits.

J R Williams *Columbus, O.*



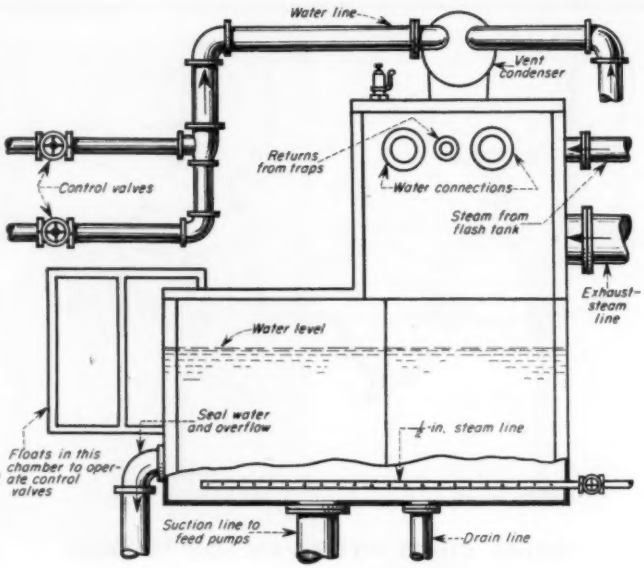
## Electric Heaters Protect Motor Insulation

Our condenser cooling water is supplied by two vertical turbine pumps driven by open-type motors. During wet weather, insulation of these motors absorbed moisture, causing their resistance to decrease. To prevent this we put four 200-w electric heaters in each motor and located them 90 deg apart inside its frame.

These heaters are required only when the motors are idle. We, therefore connected them to a normally closed contact on the motor starter. When the starter is closed to running position the heaters are disconnected. When a motor is idle its starter is open and the heater contact closes, to keep moisture out of the motor.

We also protect the motors with a sheet-steel housing as in the photo. This housing has a door front and rear for easy inspection and lubrication of the motors. To insure ventilation of the motors, side walls of the housing are up from the floor. Since making these changes insulation resistance of the motors has remained practically constant.

J R Brown *Havana, Cuba*




## WATER CIRCULATION STOPS HEATER LEAKS

To stop joints leaking in a feedwater heater in the Uxbridge standby steam plant of the New England Power Co, water is circulated in the unit. In the drawing steam enters the heater on the right from a flash tank and an exhaust line. Water enters the heater near its top and mixes with the steam and goes to the lower section.

As long as the unit operates, temperature in the heater is nearly uniform from top to bottom. But when we do not use enough water to keep a good flow through the heater there is little circulation. Then we have steam in the top of the heater and water in the bottom. Joints leaked because of uneven expansion and contraction caused by a temperature difference in steam and water sections.

We considered installing a pump to circulate water in the heater during standby periods. But cost of the pump and its operation ruled it out. We then installed a ½-in. steam line in the bottom of the heater. This line runs nearly across the heater and has holes drilled on both sides to discharge steam evenly over the lower part of the unit.

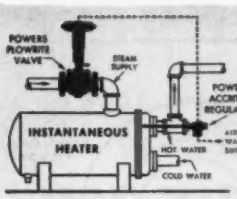
Heating the water at the bottom of the unit causes it to rise and circulate to give a more even internal temperature. This line was installed at low cost for a few hours of labor, 30 ft of pipe, two valves and a few fittings. The water is also heated by steam in the top of the heater. After installing the steam line in the heater's bottom, leaking joint rusted and sealed so repairs were not needed.

James E Bolivar *Uxbridge, Mass.*

## Setscrew and Bolt Fasten Loose Pulley to Shaft

When we have a pulley or gear that works loose from a shaft we fasten it as in the drawing. After putting the pulley in place we screw an Allen setscrew in tightly, to make a mark on the shaft. We then loosen the setscrew, remove the pulley, prick punch the center of the

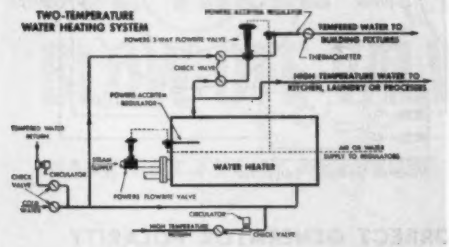
(More PRACTICAL IDEAS on page 132)

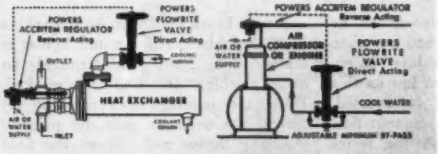


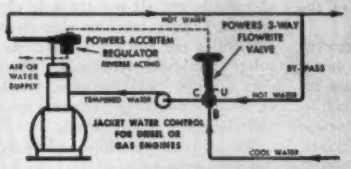

# POWERS

## ACCRITEM REGULATOR

**Only a few of many uses**



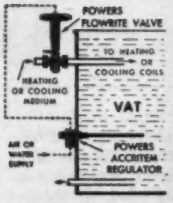

### *Gives*

## Accurate, Low-Cost Heat Control

Use Accritem Regulators to control diaphragm operated valves or dampers. They save labor, stop losses caused by over-heating and have the following—

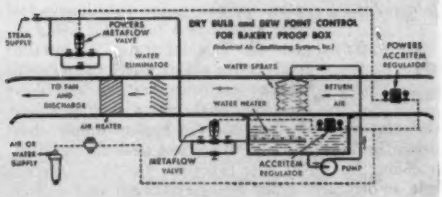
### IMPORTANT ADVANTAGES

- ***Adjustable Sensitivity*** and over-heat protection.
- ***Calibrated Dial*** temperature adjustment.
- ***Simple, Rugged Construction*** withstands vibration and insures many years of reliable service.
- ***Temperature Ranges*** 50 to 250° F. and 150 to 350° F.
- ***Easy to Install*** Requires 15 lb. supply of compressed air or water for its operation.
- ***Small Size***—regulator head is only 2⅞" x 3⅝", sensitive bulb is 12" long with ½" I.P.S. connection.



POWERS

**FLOWRITE and METAFLOW**
**Diaphragm Valves**
**controlled by a POWERS**
**ACCRITEM HEAT REGULATOR**
**provide an unbeatable combination for *better control* and *lower maintenance***




***Write for Bulletin 316***—or phone our nearest office for prices and further information about POWERS ACCRITEM regulators and diaphragm valves.

## THE POWERS REGULATOR CO.

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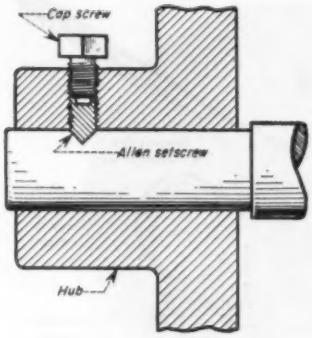
**60 Years of Temperature and Humidity Control**

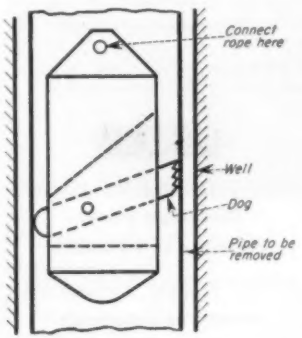
Begins on page 128




marked spot, and countersink with the point of a twist drill. Then the pulley is replaced and a short Allen setscrew tightened into the indentation.

Then we screw a soft steel capscrew down on top of the setscrew, and jam it tight. If the exposed end of the capscrew is a hazard another short setscrew can be used after drawing its temper. This method will hold most any pulley in place.

ARTHUR HOLT *Atlantic City, N. J.*



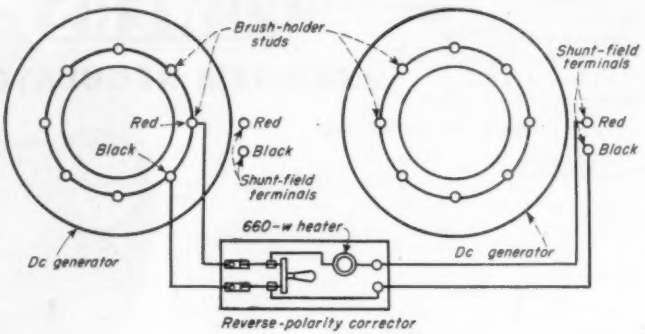

## Dog Bites Lost Pipe So It Can Be Lifted

A NUMBER OF TOOLS have been made for lifting pipe from wells after it has been lost while making repairs. But the one in the drawing I think is the best. The tool is made from a piece of shafting 5 in. long and about ½ in. less in diameter than the inside of the pipe to be lifted.

Both ends are tapered and the top one has a hole for connecting a rope. The tool is slotted in its bottom end for the dog, made of tool steel and hardened, after forming. Ends of teeth slope to make it easy to bite into the pipe.

Connect the tool to the end of a rope, lower in the well and fish it into the pipe as in the drawing. Once the tool is in the pipe a pull will cause the dog to bite so the pipe can be pulled to the surface.

D J PARMER *Quincy, Fla.*




## HOW TO CORRECT GENERATOR POLARITY

WE RUN FOUR steam-engine-driven dc generators in parallel. Sometimes when taking a generator off the line the engineer pulls the voltage too low on this machine and its polarity is reversed. This is caused by reverse current flow from the busbars through the series field coils of the machine coming off the line.

Reversed polarity can be corrected in several ways but we built a device for doing this that is safe for plant engineers to use. It consists of a double-pole switch and a 660-w heater screwed into an Edison base as in the figure. Four wires about 15 ft long connect to the switch. The free ends of the wires connecting to one pole of the switch have battery clips covered with black rubber On the other pole the wires have red-rubber-covered clips.

A plus brush holder on each machine is marked black and a minus holder is marked red. Shunt field terminals on each machine are similarly marked. When the polarity of a machine reverses, the engineer gets the polarity changing device and adjusts the field rheostat to cut all resistance in circuit. With the faulty machine shut down he connects a red and a black lead to like color shunt-field terminals. Then he does the same with the other two leads on the brush studs of a running machine and closes the heater switch.

The field coils now have right polarity. The field exciting equipment can be disconnected and the machine started. This sounds as if it might be quite a long job, but it can be done in less than 5 min.

H H BRYAN *Montreal, Que.*

## Proper Oiling Adds Life to Chain Drive

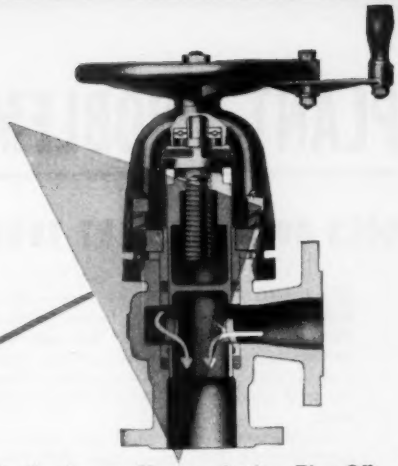
GENERATORS in our powerhouse are ventilated by a large fan driven by 15-hp motor through a silent chain. The chain runs at a 45-deg angle with the fan sprocket about 3 ft above the motors. A split plate-steel casing encloses the chain to serve as a safety and oil-splash guard for improved lube.

The chain could not be run in an oil bath, so during its first year's operation it was hand oiled. At the end of the year the chain and sprocket were so badly worn they had to be renewed. When the new chain was installed lubrication was changed to a continuous feed from a sight-feed lubricator using engine oil. This lubricator we installed in about the center of the casing's side with an extension that reached above the center of the chain's bottom strand. We adjusted the feed to supply about one pint of oil per week to the chain. For over two years the chain has run without requiring taking up the slack. From its appearance it is good for several years' more service.

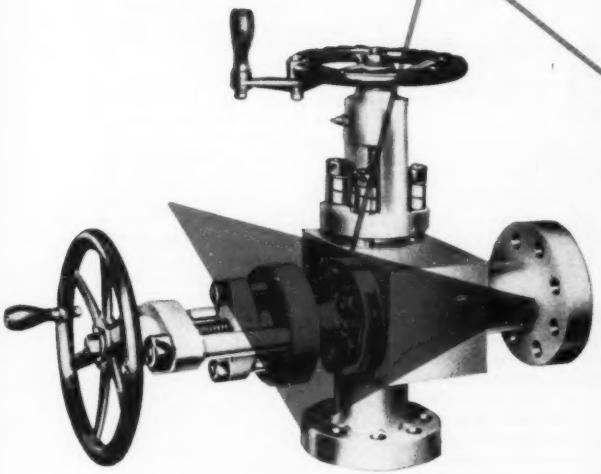
C O DIBBLE *Boston, Mass.*

# OVER 15,000 BOILER PLANTS USE THESE BLOW-OFF VALVES

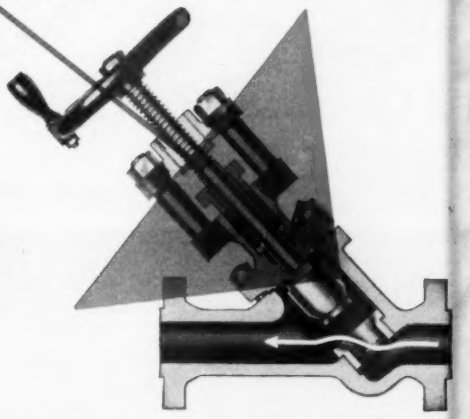
***MADE FOR EVERY PRESSURE***



This is the famous Yarway *Seatless* Blow-Off Valve. Balanced, sliding, nitralloy plunger design eliminates seat—a common source of wear, clogging and leaking. Type B (above) for pressures 50 to 400 psi, angle or straightway, single or tandem. Other types available for higher pressures. Complete description and specifications in Bulletin B-424 for pressures to 400 psi, or Bulletin B-433 for higher pressures.



The Unit Tandem—Yarway's finest blow-off valve for high pressure service. Combines a Hard Seat Valve (for blowing) and a Seatless Valve (for sealing) in a one-piece forged-steel body, flanged or socket welding ends. Also available combining two hard-seat valves. For pressures to 2500 psi. See Bulletin B-433.



This is Yarway's Stellite-Seat Valve for pressures to 2500 psi. Shown here in open position. Disc and seat ring are stellite-faced and carefully mated for tight seating, long life and hard wear. Angle or straightway, single or tandem combinations (hard seat—hard seat or hard seat—seatless) available. Complete specifications and description in Yarway Bulletin B-433.

**YARNALL-WARING COMPANY • 100 Mermaid Avenue, Philadelphia 18, Pa.**

BRANCH OFFICES IN PRINCIPAL CITIES

YARWAY STEAM PLANT EQUIPMENT

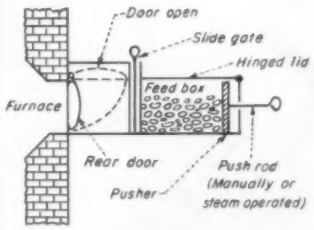
# PLANT PROBLEMS . . . *put your know-how to work*

## DOES COLD AIR HURT TUBES OR SETTING?

**HERE ARE THE FACTS: We have a 1000-sq-ft A-type watertube boiler, burning gas and oil, in our packing plant. Furnace has a 20x24-in. rear door. Through this door we fire trash (wood, wet and dry paper, greasy sausage peelings, etc). When burning trash we must admit air through the rear door. Most of the air passes over the trash unused. Also, door is open for long time while we fire trash.**

**Can this cold air coming in rear door crystallize boiler tubes or harm setting? If so, how can we fire trash without keeping door open?—GFP, May POWER**

## HERE ARE THE ANSWERS




**DON'T WASTE HEAT.** A 20x24-in. door has an area of 31/3 sq ft. With air velocity of only 500 fpm, over 1600 cfm of cold air enters furnace while door is open. Actual amount admitted depends on draft and to what extent opening is blocked. Excess air is a great heat waster. Build a feeder as in sketch *above* to cut down this loss.

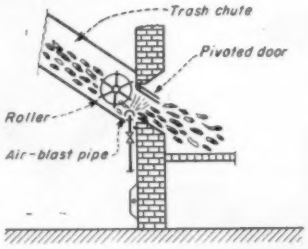
IRA A BUTCHER *Cincinnati, Ohio*

**SEPARATE BOILER** for burning trash may be good for *GFP*. Use a dutch-oven furnace. Door hinged at top and made the full width of furnace makes it easier to fire the trash. Try rocker grates that are about 15 in. below door. Then you can fire coal when there's no rubbish on hand.

W H C BISHOPRIC *Toronto, Can.*

**BUILD DUTCH OVEN** at rear of furnace and fire trash into it. But remember damage caused by long-flame high-moisture fuel may offset saving on oil. So use dutch oven only when thermal value of waste materials is worth risk of burning with oil.

OLIN L BRAGE *Spokane, Wash.*




**FIRING SECRETS.** Feed trash into furnace in a gradual stream as fast as it is burned. Complete combustion with a hot smoke-free flame is then obtained. Use inclined chute to feed trash. Fit radial-bladed rotor to lower end of chute. Install a perforated air- or steam-blast pipe between roller and furnace wall. Two doors seal chute end. Rotor, turned by a motor, feeds trash sliding down chute to air or steam pipe. Blast lifts pieces and scatters them in furnace.

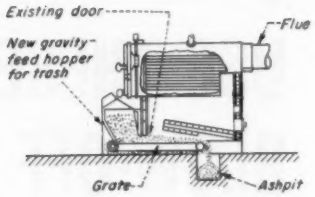
C A WILKES *Oaklyn, N.J.*

**AIR WON'T HURT TUBES.** While firing trash, air will be diffused in setting and preheated somewhat. So it won't harm tubes. But excess air lowers efficiency. Fire trash with chute, using tools to push it in. Trash will block furnace opening, preventing entrance of too much air.

W E BELL *Salem, Mich.*

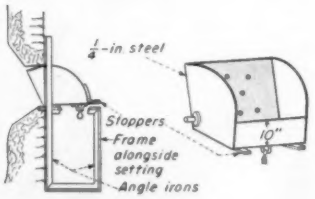
**INSTALL GARBAGE-DISPOSAL BOILER** to save a lot of trouble. Keeping door open will eventually cost more than an efficient garbage-disposal boiler.

CHARLES H ELBERT *Irvington, N.J.*




**TRY STOKER HOPPER.** Setup in sketch *above* worked well with a firetube boiler. It cuts excess air, preheats trash to reduce moisture content. Try cutting trash into small pieces. This gives quicker drying, earlier combustion and may prevent dead spots in fuel bed.

A J BREUGELMANS *Hoboken, N.J.*




**USE SWING CHUTE.** Sketch *above* shows good chute for trash firing. *GFP*'s door seems a little small but he can easily enlarge it. Cold air does hurt tubes and settings. Keep it out of furnace if at all possible. Fire greasy sausage peelings during day. Store other refuse and fire at night when boiler is off.

JOHN M GORRIE *Richmond, Va.*

**TEMPERATURE DIFFERENCE** hurts tubes, not the air itself. Besides, the rear door wasn't put on the boiler for trash firing. With a large amount of excess air coming in rear door, oily vapors from greasy sausage peelings will be carried to rear tubes where they will adhere. Trouble is certain to result.

Don't burn trash in boiler. Install an incinerator or build one. Be sure it is large enough and properly connected to the breeching with a damper.

W T MULLEN *Philadelphia, Pa.*

**TRASH BURNING IS DANGEROUS** if not done in an incinerator. So either dispose of it this way or pay to have it carted away.

A CANNON, *Lawrence Harbor, N.J.*
CARL A FREY *Chicago, Ill.*

# help the other guy cure his headaches

TYLER HICKS, *Assistant Editor*

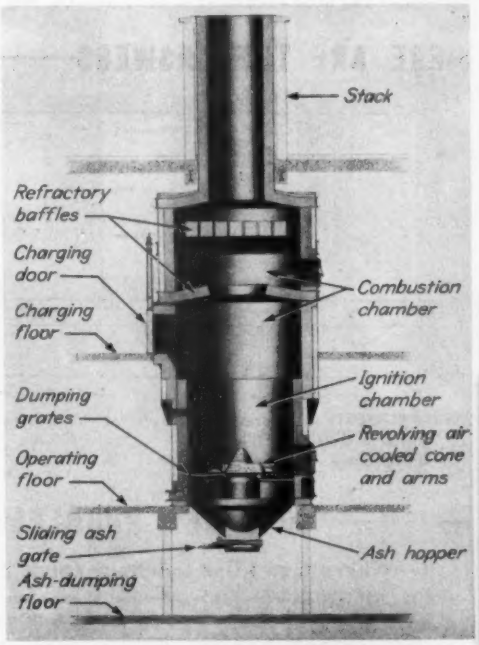
**BOILERS AREN'T INCINERATORS.** They are designed to convert heat from a fuel into steam, not for disposing of industrial waste. *GFP* is sure to run into trouble if he burns trash under the boiler. What he needs is an incinerator suited to his plant.

Unlike boilers, industrial-plant incinerators have a furnace especially designed for high-temperature heavy-duty refuse applications. Combustibles in the waste are destroyed without smoke or nuisance. To do this right there must be sufficient combustion space with a grate arrangement and charging door or gate that permit feeding masses of waste material with minimum labor in the shortest time. Time is important because the longer the charging door is open, the more excess air is drawn into furnace, lowering unit performance.

Industrial plants are becoming more and more sanitary-minded. If they don't believe in sanitary practices, the neighboring community soon compels them to change their ways. Dumping odorous and unsightly refuse is no longer tolerated in the average community. To this is added the problem of disposal of unusual wastes, generally manufacturing by-products. These include waste solvents, large quantities of toxic or odorous liquids, fumes and sludges. Many well-designed incinerators are available. *GFP* should look into these because capacities range from as low as 150 lb per hr to several hundred tons per day.

Unit in sketch, *at right*, has furnace, combustion chamber and chimney in one vertical setting. Capacities range from 1000 lb per hr to 50 tons per 24 hr. If *GFP* has sufficient refuse for one of these units, he'll find that manual stoking is completely eliminated and a high burning rate obtained. Variations of this design are used for evaporation and decomposition of waste liquids, solvents and hard-to-burn sludges. Always consult engineers who know incinerators.

J. I. FRANKEL, *Nichols Engrg & Research Corp, N. Y. C.*

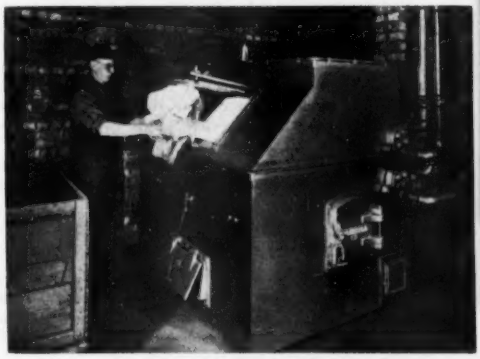



**DON'T BURN TRASH IN BOILER.** It pushes boiler efficiency down. While door is open to fire trash, large quantities of excess air enter boiler, passes become congested, and stack is overloaded. Burning rubbish also fills boiler passes with flyash. Cold air entering the furnace may strike hot refractory walls, causing serious spalling of refractory lining.

There is no way to overcome these conditions while firing trash in a small boiler. What *GFP* needs is a small incinerator to dispose of plant rubbish.

Photo, *at right*, shows a portable steel-cased incinerator of moderate size that would be good in *GFP*'s plant. It is fitted with a hot-water heater and performs either or both of two functions: rubbish disposal, and heating of water for process or domestic demands.

F S RIEDER *Plibrico Jointless Firebrick Co, Chicago*



**AIR CAN AFFECT DRAFT.** If cold air flows in above burners it may overload the i-d fans. Tubes near door may develop localized stresses. Fit closed hopper over rear door so all trash may be charged while door is closed. When hopper is full, charging door is closed and furance door opened, allowing trash to slide in.

*GFP* can install the suggested equipment himself or have the job done by a contractor. Either way it should work.

VINCENT STROJSA *Glace Bay, N.S.*

## HOW CAN I STOP OUR LAMP VIBRATION?

**HERE ARE THE FACTS: I'm having plenty of trouble trying to keep lamp replacement down in our pulp mill. We checked voltage in all circuits and found it right for the job. In general, lamp locations are favorable except in certain sections of the mill where there is considerable vibration.**

**At present we use 750-hr incandescent lamps. They burn out sooner than they should. I think vibration shortens their life.**

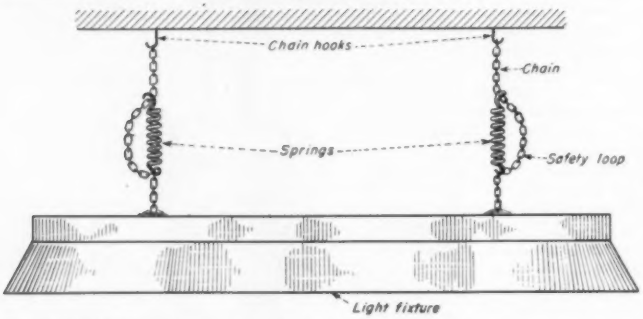
**Can I mount lamps in a way that will reduce vibration of fixtures**

# More PLANT PROBLEMS

Begins on page 134

**and bulbs? Or are there special bulbs I can use where there is severe vibration? Which setup gives longest life? How are fixtures that absorb vibration installed on concrete ceilings? Wooden ceilings? Can plant electricians do the job?—YM, May POWER**

## HERE ARE THE ANSWERS




**CHAIN SUPPORTS** with springs hooked in them, as in sketch *above*, keep vibration from lamps. We solved similar problem with the same setup in our plant. Results have been excellent.

D J Parmer *Quincy, Fla.*

## YOUR NEW PROBLEMS

### 1—Where Can I Use Solenoid Valves?

**I'M CHIEF of an average-size industrial plant, in charge of all power services. Recently I came across a bargain, a large number of surplus valves—gates, globes, safeties, solenoids, checks, prv's, plugs, etc.**

**We've purchased them for different purposes in the plant. To date we've found one or more uses for every type. But we'd like to check with *Power* readers on the solenoid valves. We intend to use them in refrigeration liquid and cooling-water lines, manufactured gas lines to process and for air-compressor relief during starting. It seems to me that an industrial plant of our size, with steam, water, heating, air conditioning and other services, could use these valves in more places. Sizes are ⅛ to 2 in., ratings to 250 psi. Some are 2- and some 3-way.**

**We'd like suggestions from *Power* readers and hookup sketches for solenoid valves. Since we have quite a few we can use them in a number of places for control and shutoff—DP**

### 2—Is This Diesel Engine Timed Right?

**WE HAVE an 8-cyl 4-cycle 14½x18-in. diesel that develops 665 hp at 300 rpm. Timing of engine valves doesn't agree with builder's though tappet clearances are correctly adjusted. Engineers have told us this doesn't affect power output of engine but we're wondering if they're right. Here's how timing sets up:**

**BUILDER'S: Inlet opens 6 deg before top dead center (btc), closes 14 deg after bottom dead center (abc); Exhaust opens 34 deg before bottom dead center (bbc), closes 12 deg after top dead center (atc).**

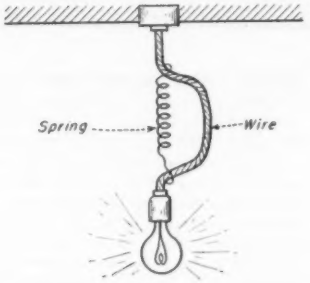
**ACTUAL: Inlet opens 15 deg btc, closes 43 deg abc; Exhaust opens 37 deg bbc, closes 15 deg atc.**

**Since inlet valve has such a late closing, are we losing some air at the start of the compression stroke?**

**Other items we need help with are: Is there an exact way of finding piston or flywheel position of this engine when fuel injection takes place? Can any instrument besides an indicator be used to set fuel cams? We can't bar engine over fast enough for accurate check.**

**Sketches or photos of easiest ways will be most helpful—NS**

Will you help these readers? Published answers are paid for; extra for photos, sketches.

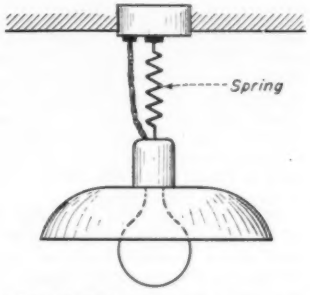



**STANDARD BULBS** have many advantages. Use spring suspension as in sketch *above*. Make spring suitable for weight supported. *Editor's Note: Check local code before adopting method.*

Henry H Demling *Bronx, N.Y.*

**NO RIGID CONNECTIONS** should be made between light socket and ceiling. Dampen vibration by installing light socket on felt padding and using rubber-covered cord between light and conduit. Incandescent lamps usually break from vibration when no current is passing through them. If 15 or 20 volts is applied to lamp the filament will warm up, reducing breakage. Before installing a large number of gaskets try rough-service bulbs. They may do trick.

Frank Raphaelian *Millburn, N.J.*




**COIL SPRINGS** make good support, as shown in sketch *above*. If lamp vibrates when suspended by spring, change weight or length of spring. Springs can be attached to both concrete and wooden ceilings. Special lamps are not needed.

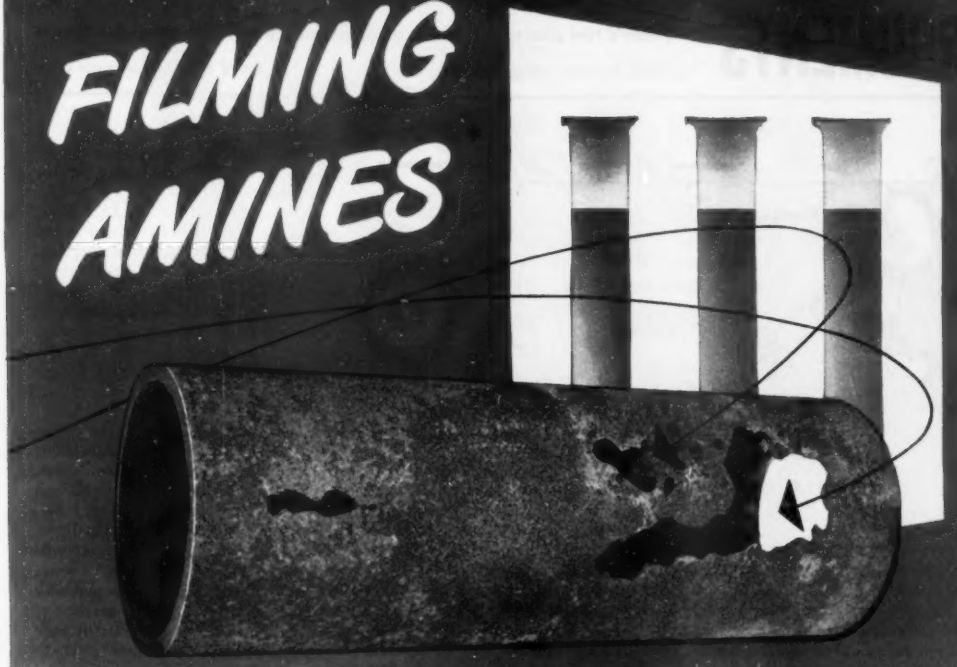
Ira A Butcher *Cincinnati, Ohio*

**MAKE SPRINGS** of ⅛-in. wire, 4 in. long. Springs worked well for us on fixtures beneath our turbine foundation and on ceiling of our pump room.

Vincent Strojsa *Glace Bay, N.S.*

(*Continued on page* 198)

# FILMING AMINES



## Prevent Return Line Corrosion

*Send for Betz Technical Paper #121, "How Filming Amines Prevent Steam and Return Line Corrosion."*

*CORROSION of steam and condensate return lines is a serious problem to most industrial plants.* Such corrosion is caused by the presence of carbon dioxide and oxygen. Up to now, it has been the usual practice to neutralize the carbon dioxide. However, the high cost of this neutralization method has limited its application. And, no protection against oxygen corrosion is assured.

Betz Laboratories have developed a new advanced process for the prevention of return line corrosion employing *octadecylamine.* This material *does not* neutralize the carbon dioxide. Instead, the amine is adsorbed on the metal surface in a monomolecular non-wettable film which acts as a barrier between the metal and the condensate, protecting against both oxygen and carbon dioxide attack. The monomolecular film does not increase in thickness with continued treatment.

Results? As high as 99 per cent reduction in corrosion rate has been achieved. Maintenance and replacement costs on return line systems have been reduced to negligible amounts.

Let a Betz Field Engineer show how you can cut costs in your plant with the use of filming amines. Write today! There's no obligation of course. W. H. & L. D. BETZ, Gillingham and Worth Streets, Philadelphia 24, Pa. In Canada: BETZ Laboratories, Limited, Montreal 1.

[a] U. S. PATENT 2,460,259
CANADIAN PATENT 461,238

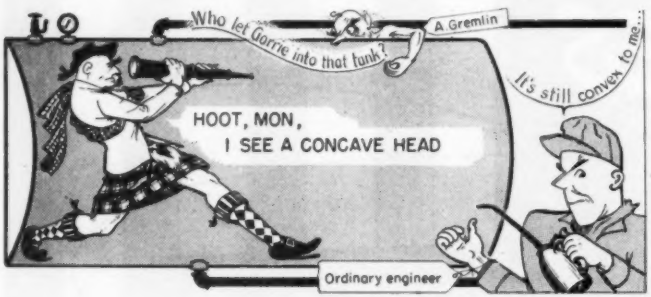
**BETZ**

BOILER WATER CONDITIONING • COOLING WATER CONDITIONING • INDUSTRIAL WASTE TREATMENT

# ARGUMENTS

***Here's the place to unload your gripes to editors, manufacturers and fellow engineers***

**STEVE ELONKA,** *Associate Editor*




## EVEN A SCOT CAN BE WRONG

*Gorrie says:*

OCH, WIT KIND o' engineers are ye? Callin' concave head a convex one. Man o' man that's affie bad, whan engineers dinna ken the difference atween a convex an' a concave head. Bill Davis sure slippit up, an' so did the editors.

Funny thing. There are many engineers who cannot tell the difference between a convex or concave head. They know what a plus and minus head are, and many talk of dished heads, but the convexing problem is in the concavity. You tell a head from the *pressure* side.

JOHN GORRIE *Richmond, Va.*

*Editors say:*

OKAY MR. GORRIE. A kilty's a skirt, but the Scots call it a kilty, which makes it that.

What we call a convex head has the pressure on the concave side, as you say. What we call a concave head has the pressure on the convex side, as you say. You are right on both these counts

*But,* we are not talking about where the pressure is. We are talking about the accepted name, in America (we don't know about Scotland). Except Gorrie, engineers over here call a head convex when it sticks out and concave when it curves in—*both viewed from the outside.* It's simply a matter of the name of a thing, as determined by the custom of the country.

PHIL SWAIN and STEVE ELONKA

## Go Easy on That $CO_2$

I'D LIKE TO COMMENT on the article about relay protection for ac generators in April POWER, p 94. Differential protection for the stator and leads is a very good practice, and I believe it to be a rather new development, as I have not seen it except in plants built within the past five years.

I disagree with the experts about having the differential relay set off the $CO_2$ system. My argument arises from a very recent experience where a fault occurred outside our generator stator, but within the protection range of the differential relays. In that case there was no need of the $CO_2$ system being discharged and making it necessary to spend time and effort cleaning it and drying out the generator. We had just disconnected the $CO_2$ system from the differential-relay hookup, so were able to get the machine back on the line in a matter of minutes. As the fault was in the standby auxiliary transformer, the unit was put back to work while repairs were being made.

If the $CO_2$ had been discharged, it would have taken a day or two to clear up. I believe the thermostats will be enough to discharge the $CO_2$ for a fire within the generator windings.

Do you know of any case where a generator differential fault has occurred and it was best that the $CO_2$ was set off at the time of the fault?

DAMON L SHULTS *Bliss, Idaho*

*Jim O'Connor's Answer:*

JUDGING BY my own experience, it isn't usual to operate fire-extinguishing equipment by differential relays. The very aim of differential protection is to disconnect the generator from the station bus before the fire starts in the machine. In most large ac generators the fire-extinguishing equipment is operated by thermostats buried in the stator windings.

But recent findings of the AIEE Committee on Generator Protection reveal some cases where differential relays have operated the fire-extinguishing equipment.

As I see it, you are on safe ground in using extended differential protection without the fire-extinguishing tripping.

## How About Copper Ferrules?

OPERATORS' NOTEBOOK 41, May POWER, shows copper ferrules used in enlarged tubesheet holes around boiler tubes. We have two schools of thought there.

One is for copper, the other for soft-iron ferrules. What's the answer? What are the dangers of galvanic action with copper? If there is the least seepage of alkaline water, what effect will it have on the copper? If there is least seepage at such a seal, will tubesheet or tube be affected and leak worse?

I'm curious to know what reliable test data shows on these points. What do POWER readers say who have run into this problem? Until I know definitely, I'll continue to use black-iron strips.

A M COX *Pacific Grove, Cal.*

EDITOR'S NOTE: *I have used both copper and black iron for this purpose. Copper ferrules are manufactured by at least one leading firm. Copper ferrules are also used in boilers up to 200 psi on superheater and economizer plugs. What experience have you readers had?*

STEVE ELONKA

## The Fine Points Of Tube Rolling

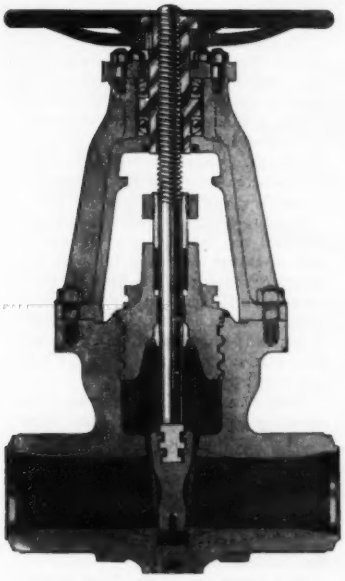
IN OPERATORS' NOTEBOOK 41, p 112, May POWER, Steve Elonka shows inside cutter used on bottom row tubes so they drop into firebox or to bottom of hrt boiler. This is fine, but why not use same method in all the rows?

One trick is to get cutter back of seat. Another is to keep lengthening cutter out ¼ in. at one end of each row so each row is shorter. Then tubes will not catch on stub ends.

Copper ferrules have been used for a long time, but I believe difference in metal, plus chemical in water, might set up an electrolytic action. I prefer

# CONTROLLED POWER...

## WITH LUNKENHEIMER *Breech Lock Valves*



VENTURI OR FULLWAY ENDS

1500 Lbs. Cast-Steel Breech Lock Gate Valve

The Lunkenheimer body-bonnet Breech Lock valve follows the principle used in large guns, except that locking is not accomplished by a thread wedging action. Rather, four series of three heavy annular lugs on the bonnet and in the body intermesh and lock the two parts together. Stress is evenly distributed, and the full internal pressure is carried by the breech lugs. Pressure tightness is maintained by sealing the joint with a seal weld, which can be chipped out to release the bonnet, if necessary.

The combination of lugs and seal weld possesses a strength and structural stability not attainable in any type of construction that must depend upon some form of gasket for pressure-tightness. Also, a joint is virtually eliminated by the integral union of body and bonnet with a seal weld. *Leakage is impossible, and maintenance never required.* In effect, the Breech Lock with Seal Weld has all the advantages of the Strength Welded Bonnet design, plus the added advantage of easy disassembly and reassembly in the field.

*Write for your copy of "Lunkenheimer Cast Steels," a brochure describing basic research in alloys for high-pressure, high-temperature valves.* Address: The Lunkenheimer Company, Box 360A, Cincinnati 14, Ohio.

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**LUNKENHEIMER**

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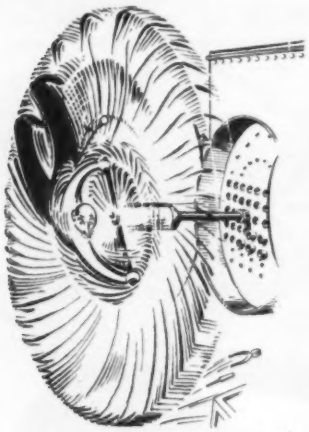
L-251-6

Begins on page 138



strap iron. If I had to use copper, I'd make joint much longer than Steve's.

How about baffles? I mean vertical baffles of brick or cast iron. Your brick drops out of place when removing one or more tubes. If not placed back, baffle with no brick will get full effect of heat. Another thing, your new tube may chop off some of fallen brick. Then it gets into new tube and if not noticed, it's down in your blowoff valve. If brick breaks or falls apart, I always use plastic to fill space.

Now ¼ or ½ in. is OK on tube ends, but ⅜ in. is better. If tube does slip, you still have ¼ in. on one end and ½ in. on the other. With ¼ in., any slippage and you're out of luck. With ½ in., you may have job of trimming off ⅛ in. or more on one end.

Next watch some types of expanders. Their tapered rolls have a terrific shearing action against edge of tube hole if expanding and belling goes too far.

When you use a power outfit, it's much safer to have one man on each handle. If only one man for job, insert two fairly long pieces of pipe in the tubes on top of right-hand handle and below left-hand handle. When expander starts to grip, it develops a terrific back-hand torque that has been known to break a wrist, or knock the operator off his platform.

E J DUFF *Aurora, Colo.*

*Editor's Note.* Ed Duff did boiler maintenance for one of the large boiler manufacturers, and I agree with everything he says. But in a 2-page article packed with 18 sketches, there's only so much room. No doubt you readers have further comments on this. Send them in.

STEVE ELONKA

## The Wide Open Spaces Of Engineering

I AM 55 YEARS OLD, not considered too old as chief engineers go, and have been in the mechanical game since 1910. I started to serve my machinist's apprenticeship in 1911 and took my first shift in 1922. Since that time I have seen a few changes.

I was always a rather avid reader, and well recall some of the family arguments between my grandfather and my father (both were engineers, and good ones) about a lot of things. DeForest was experimenting with a so-called vacuum tube that would do a lot of things in the field of wireless telegraphy, itself a miracle.

The St. Louis World's Fair was still rather fresh, and we had gone to view it. Many were the talks about the marvelous new idea, the big Diesel engine that lit up a whole building. I recall my father sitting up many winter nights, plotting innumerable curves and diagrams to give him a better understanding of this new alternating current that was coming into use.

"Truly," I used to think, watching and listening, "This is the golden age of engineering; everything will be thought out and found out by the time I get a plant." In 40 years, I have learned the error in my youthful thinking. The golden age is, and always has been, the future.

**Your Wonderful Opportunity.** That is the thought I'd like to get across to the young fellow who is taking his first job as a fireman or oiler, or possibly even a wiper. He has his foot on the bottom rung of the ladder. He can climb a long way, and, if he is a real engineer, each step up will make his work a lot more satisfying.

As far as I can see, none of us has reached the top of that ladder. Some of us have been able to climb high enough so our horizon is a little more distant. Yet between us and that horizon are approaching a lot of things that will prove both interesting and a challenge: utilization of atomic power, synthetic fuels, cold light, the gas turbine, etc.

Each first appears as a dim speck on the horizon. As we get closer, the details begin to show up. Finally we are up against a mountain, but by collective thought and planning we are ready to tackle it when we meet it.

**New Worlds to Conquer.** When we have reached the top, we can pause and think, "Well, it was tough, but we whipped it." Then, after we have caught our breath and stand up to look around, we see, far away on the horizon, another little speck. Then we realize that beyond that little speck, which we know will prove another mountain, there are other little specks, but we have confidence that, as we reach them, we shall conquer them too.

To wind up this rather lengthy missive let me say that I really feel I know a lot of the boys who contribute to the pages of POWER, and hope some day I can forward an idea or two that might prove of interest.

FRANK J LANDON *Tucson, Ariz.*
*Sup't, U.S. Post Office, Court House*

## Hot-Water-Heat Argument

I HOPE too many readers won't follow Ardolino's advice not to use automatic feed (May POWER, p 120). We've gone a long way since the days of old-fashioned gravity systems. Today, hot-water heating systems are nearly all automatically controlled, and are often left unattended for long periods.

With nobody around, any alarm is useless. For utmost safety in conjunction with automatic operation, a low-water cutoff switch is better than an alarm. A high-water cutoff should not be needed if the relief valve isn't set higher than safe operating pressure. For cast-iron boilers and radiators this is usually 30 psi.

If entire system is above ground and exposed, any leak is easy to find. If part of system is hidden (as with underground piping, panel heating, etc), an occasional glance at a simple water meter installed in feed line will show if system is losing water. In any event, keep that automatic feed running! You may save a boiler.

Ardolino's statements that an open expansion tank should be "located above the highest radiator," and that closed (expansion) tanks can be placed at a low elevation, are misleading. An open tank should be located 3 ft or more above highest *point* of the *system*. With an overhead system, radiators are below the mains.

In a forced-circulation closed system, location of tank depends entirely on individual hookup. For instance, tank must be above highest point if system is an overhead one, or one where all radiators are on same level or below boiler, with main lines running along or below floor.

A CANNON *Lawrence Harbor, N. J.*

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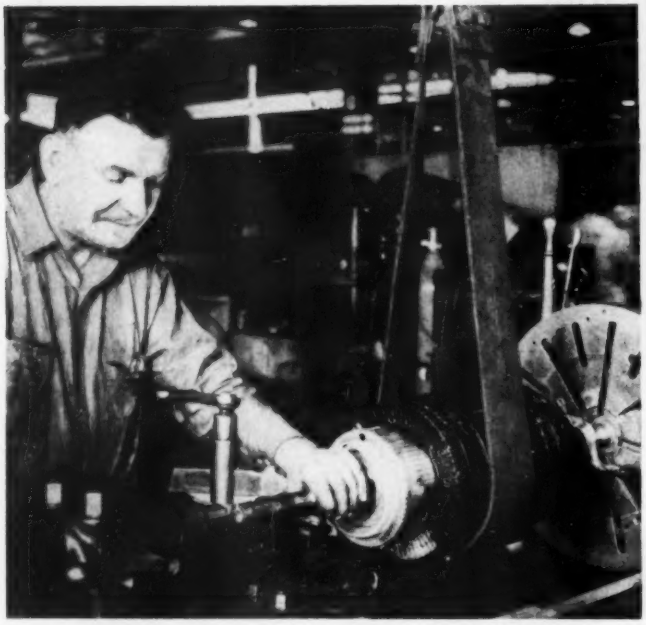
# HOW TO TURN DOWN COMMUTATORS



**PLACE BETWEEN CENTERS** with sling so insulation isn't damaged. Make sure shaft centers are clean and lathe centers lubricated. Place so commutator is at tailstock end and tool feeds against headstock. Grind tool pointed and stone smooth

**ROUND SHARP EDGE** so it's safe when assembled in machine. You can file round but first slow lathe to slower speed

## 6 EASY STEPS IN AN IMPORTANT JOB

**1** Clean centers in shaft ends, place armature between lathe centers, with commutator at tailstock end

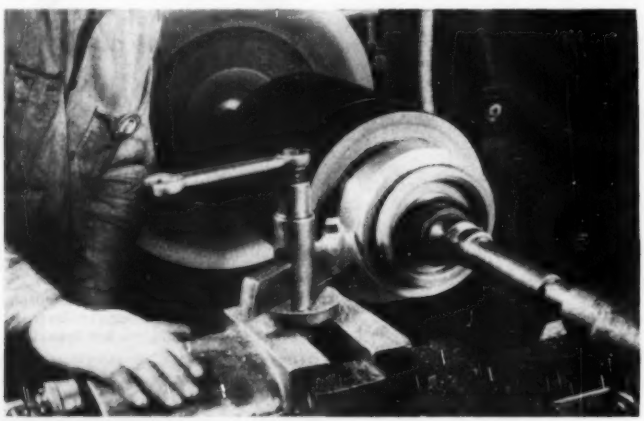
**2** Grind tool to V-point, rounding tip slightly by hand with grinding stone. Grind top flat, no rake

**3** Set speed so commutator travels about 300 ft per min; 1200 divided by commutator diameter (inches) gives rpm for this job

**4** Set machine to finest power feed you have. That's usually 40 threads per in.

**5** Take a light cut, just deep enough to barely clean up surface. If needed, take a second cut

**6** For bright finish, polish commutator with fine sandpaper or grinding cloth. NEVER USE EMERY. Then blow grit off with air



**FIND LOWEST SPOT** on commutator by running in feed so tool touches paper held against low area. Note depth on graduated crossfeed. Take cut to almost this depth. Then take final cut to clean up surface. Polish with fine abrasive paper or cloth

# A STEAM TRAP MECHANISM
## GOOD FOR 900°F, 950 PSIG
**. . . will last a long time on low and medium pressures**

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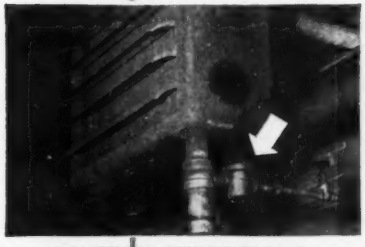
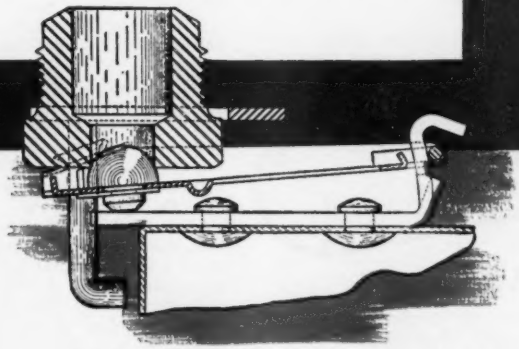


"50% LESS TRAP MAINTENANCE since installing Armstrongs on low pressure vacuum return heating system." . . . John Deere Ottumwa Works, Ottumwa, Iowa.



THE valve and seat in *every* Armstrong Inverted Bucket Steam Trap are chrome steel — hardened, ground and lapped to a steam-tight fit. The valve lever assembly and the bucket are corrosion resistant 18-8 stainless. You get the same design, workmanship and materials whether you order traps for a low pressure heating application or for a high pressure power plant application. *In other words, you get the longest-lasting, most trouble-free trap that money can buy at no premium in price.* If you think you'd like that, call your nearby Armstrong Representative for the traps you need now.

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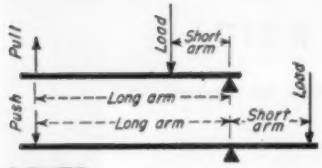
# ARMSTRONG STEAM TRAPS

# HEADWORK

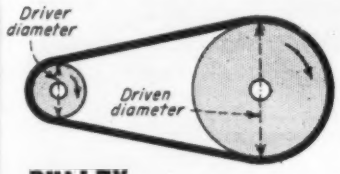
PHIL SWAIN BRINGS ENGINEERING THEORY DOWN TO EARTH

## Force Multipliers — I



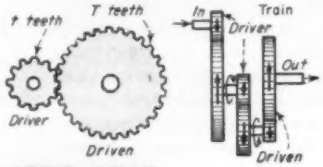

### LEVER

With the pull on long arm, and the load on short arm, multiplication factor is the long arm divided by the short arm



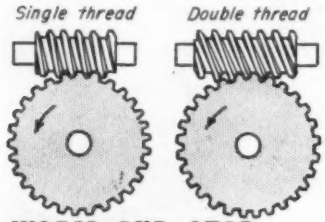

### PULLEY

Factor is the diameter of driven pulley divided by the diameter of the driver




### SPUR GEAR

Factor is number teeth on driven gear divided by number teeth on driver. For gear *train* apply this rule to each meshing pair. Factor for whole train (right) is product factors of all the pairs




### WORM AND GEAR

Factor is the number of teeth on gear in case of single threaded worm. For double thread divide this factor by 2. For triple thread divide it by 3

► HERE ARE some common ways to multiply force: Under each sketch you find the multiplication factor, neglecting friction.

For example, force-multiplication factor for a lever is the length of the long (input) arm divided by the length of the short (output) arm. If you pull 3 ft from the fulcrum, and the load is 1 ft from the fulcrum, you can lift three times the amount you pull.

In the usual case of a lever and certain other devices pictured, friction would waste only a small percentage of the applied energy. At the other extreme, friction might use up more than half the power in the case of a wedge or a screw jack. Of course the actual percentage wasted will depend on lubrication and many other factors.

It's easy to figure force multiplication factor for any special case if you remember that (neglecting friction) *the work you get out of any such machine equals the work you put in.*

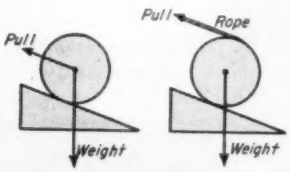
That's another way of saying *what you lose in distance you can make up in force.* In every device that multiplies force the applied force must move a greater distance than the delivered load. The force multiplication factor is merely the movement of the applied force divided by the movement of the load.

In short, if you have to push the handle 4 in. to lift the load 1 in., the machine will then multiply force by four.

Where the motion is continuous and rotary, you can substitute torque for force and rpm for speed. Thus, in pulley or gear drive, if the driving shaft rotates four times as fast as the driven shaft, the delivered torque will be four times the input torque.

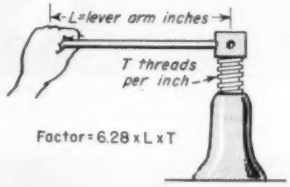
In the case of the worm and gear wheel, count how many times the worm must rotate to cause one complete rotation of the wheel. That number is the multiplication factor.

*More next month.*



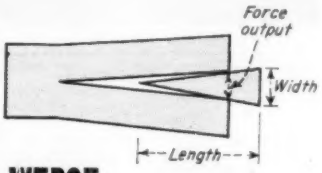

### INCLINED PLANE

See how many inches the object moves in the direction of applied pull *for each inch of rise.* Former is the multiplication factor. Usually pull is applied (as pictured) in the slant direction—the most effective. Scheme pictured at right (often used in handling barrels and heavy pipe) gives a factor double that for direct push or pull




### SCREW JACK

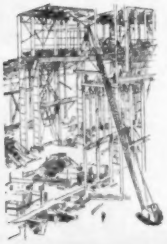
Factor is distance hand moves to raise the screw one inch. This is $2 \times 3.14 = 6.28$ times the lever arm multiplied by the number of threads per inch. But beware of very high friction (see the text)




### WEDGE

Factor is distance wedge advances for every inch of additional separation of the parts being wedged. This equals the length of wedge, divided by width

# 33½ miles of tubes for new smelter in Chile



Sketch from photographs of current construction of new smelter at Chuquicamata Mine of Chile Exploration Co.

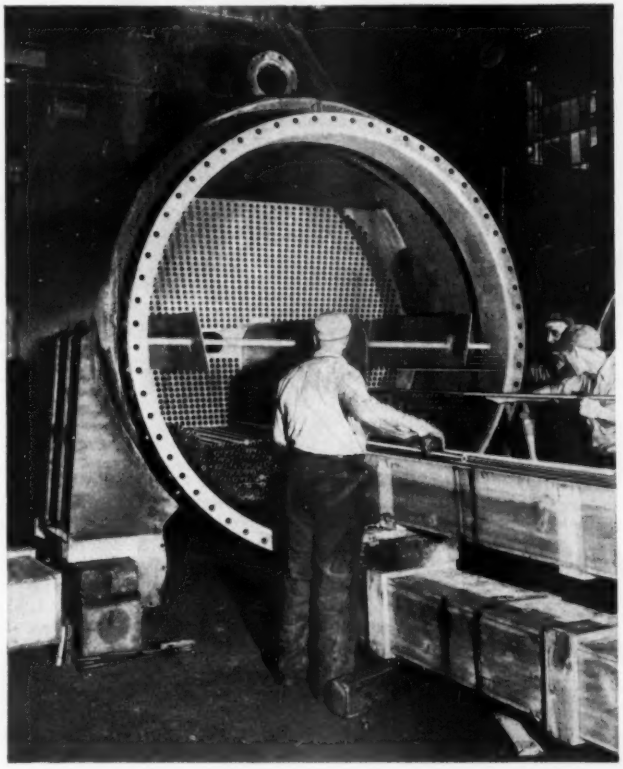
The new sulphide ore reduction plant of the Chile Exploration Co. at Chuquicamata, Chile, is an example of the wide range of factors and conditions that influence tube alloy selection. Condensers, evaporators and feed water heaters are all involved, in addition to more than 5 miles of instrument air piping.

**CONDENSERS** – The brackish, alkaline cooling water available in Chuquicamata dictated the use of Ambraloy 927, Anaconda's Arsenical Aluminum Brass, as the practical condenser tube alloy. 132,000 feet are being installed.

**EVAPORATORS** – To supply boiler make-up water, distilled from the same supply as the condenser cooling water, 7,364 feet of ANACONDA Cupro-Nickel 712 (20% nickel) tubes are being used.

**FEED WATER HEATERS** for the distilled boiler make-up water are using 11,000 feet of ANACONDA Arsenical Admiralty 439 Tubes.

**INSTRUMENT AIR PIPING** is made of 28,000 feet of ANACONDA Red Brass Tubing in view of the presence of sulphurous gases created by smelting copper ore.



AnacondA Ambraloy 927 Tubes (U.S. Patent No. 2,003,685) being installed in condenser built by C. H. Wheeler Mfg. Co. for Chile Exploration Co. Each of the four condensers requires 33,000 ft. of tubes.

*Whatever the conditions under which your condensers or heat exchangers operate, they have most likely been encountered in the experience of our Technical Department engineers. The services of our Technical Department are freely available to you. Just write to The American Brass Co., Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.* 81122

***For efficient heat transfer***

**ANACONDA® CONDENSER TUBES**

In San Pedro, Mike packed his sea bag and left the SS *Heliopolis*

# Marmaduke Pulls a Fast One

► I GET HOMESICK for a ship about this time of year and find myself wandering along the water front every chance I have. And once I hit the docks along South St, it's only a few blocks to Maiden Lane. That's the home of Marine Engineers Beneficial Association's Local No. 33.

"We're having a meeting downstairs pretty soon," said good-natured Business Manager Earl King. "Why don't you come down and meet some of your old shipmates?"

"Good deal," I answered. "Let's go."

The hall was packed with hundreds of marine engineers. But you couldn't see the walls for tobacco smoke. Earl King rapped for order. "Is there any unfinished business before the house?" he asked.

"BILGEWATER ON UNFINISHED BUSINESS," roared a familiar foghorn voice from the rear. "I'LL TELL YOU ABOUT BUSINESS I FINISHED FOR GOOD."

Did your ship ever throw a propeller blade while racing full speed across the Atlantic? Well—that's the effect that blast had on the audience. Marmaduke Surfaceblow had the floor, and I mean all six feet four inches of him. We craned our necks toward that thunder.

"Stop the engines," croaked a burly mariner next to me. But Earl King had a broad grin on his face. He had run into Marmaduke before. And he knew for sure when he was licked for good.

"Looks like we'll now hear brother Surfaceblow, marine and stationary engineer extraordinary," announced King, "whether we want to or not."

"AHOY, SURFACEBLOW," yelled everyone in unison, hurling their voices strong and loud against the rafters.

General MacArthur might have had his day, but this was Marmaduke's hour. Through the smoke we made out our hero, plowing his way majestically to the platform. The old gray bowler was down at the bow and Marmy wobbled only a little, like a square rigger rolling with a heavy ground swell. It was easy to see brother members had taken him in tow to the Bent Propeller Bar. He was loaded well below his Plimsoll mark with liquid cargo.

Marmaduke faced his audience and plopped down on the desk. He leisurely took a drag on his cigar stub and blew a Ringelmann No. 4 cloud of smoke toward the overhead. Then he anchored his mudhooks in the armpits of his checked vest. All eyes were on Marmy as he blasted away.

"Back in 1916 I was on the beach in Seattle. So I shipped as water tender on the intercoastal ship *SS Heliopolis*, to get back to Boston. The chief promised me the second engineer's berth on the East coast. The *Heliopolis* was a turbine gear-reduction job with watertube boilers. She spent a lot of time in West coast ports. Port watches were eight hours straight, with one water tender running the plant on each watch. The engineers, oilers and firemen were on day work in port, doing maintenance.

"One water tender was Mike Brannigan, a tough old two-fisted Irishman from the Auld Saud. He had been tending water for so long he finally turned sour. Like many old-timers, he believed he knew all the tricks and that everyone was out to foul him up. So he walked around with a chip on his shoulder. He didn't like my looks and let it be known he'd run me off the ship.

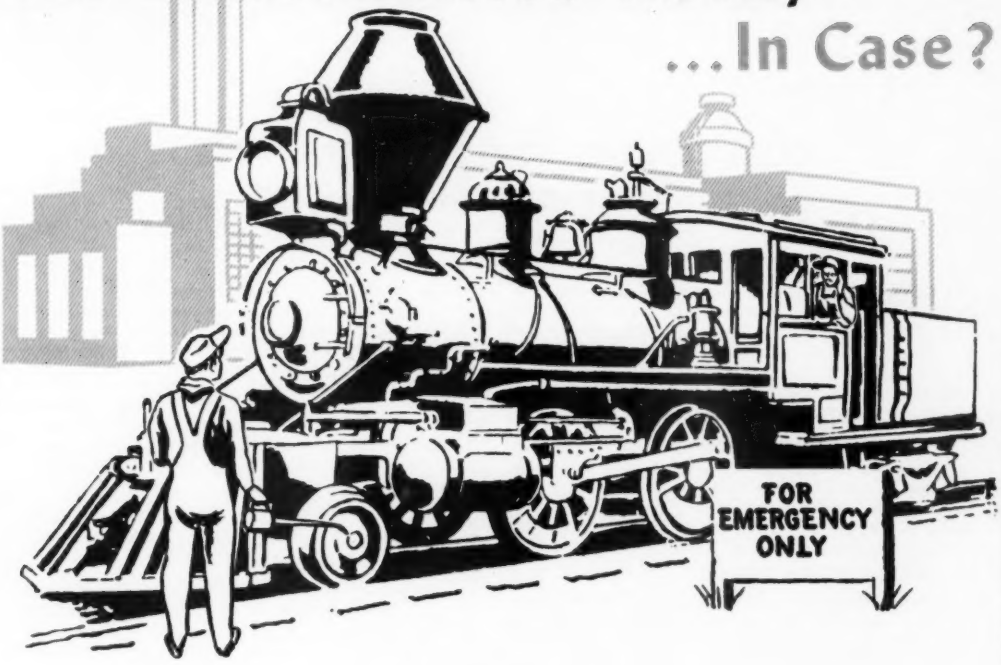
"Mike had the 8 to 4 in port, and I took over from him on the 4 to 12. First time I changed over the big twin-suction fuel-oil strainer I almost got an oil bath. Mike had loosened the clean strainer's cover. Next watch, when longshoremen needed more steam on deck, I lit off an extra burner. This time Mike left the tips out of the spare burners and I had a bad flare back.

"I didn't say a word to anyone. Two can play that game, but it takes skulduggery and headwork. After that, I gave everything the eagle eye on taking over. Nothing more happened, but I found plenty wrong.

"This is the sweetest-running boat

(*Continued on page* 208)

# Got a Locomotive Handy ...In Case?




EVERY so often a steam locomotive makes news by going to the rescue of a plant where the steam system gave out at a critical time.

This is one answer to continued steam production pending repairs . . . and undoubtedly an expensive one. Simplest—and most economical—is to use the Nalco System and eliminate the chances of boiler down time due to faulty water treatment.

Nalco chemicals and services aim at *water treatment results* from raw water intake to condensate hot well . . . And the thousands of plants now using the Nalco System testify to the accuracy of this aim during the past twenty-six years. Whether your plant is large or small; your water problems scale, corrosion, carry-over—or just plain high cost—unless you have a locomotive handy for emergencies, better check with Nalco today. No obligation . . . and an excellent chance for permanent water treatment security.

P. S. More steam locomotives use Nalco-treated water than any other kind . . . Perhaps the reason why locomotives *can* be of help in plant emergencies!

**NATIONAL ALUMINATE CORPORATION**
**6222 West 66th Place • Chicago 38, Illinois**
*Canadian inquiries should be addressed to*
*Alchem Limited, Burlington, Ontario, Canada*

**THE *Nalco* SYSTEM . . . Serving Industry through Practical Applied Science**

# JENKINS PRACTICAL PIPING LAYOUTS

57

*How to plan*

## CONNECTIONS FOR COMMONLY USED TYPES OF METERS

**In practically all industries** meters are employed extensively to compute automatically and accurately the amount of flow. Fluids measured may be liquid, gas, or vapor (water, oil, gasoline, fuel gas, steam). Metering is also required in the preparation of beverages, syrups, and other food products, and of various chemicals, to mention only a few processed fluids.

**Many types of meters are available** to perform specific functions, such as indicating, totalizing, recording, or any combination. These diagrams show the basic piping hookups for several of the more commonly used meters. For the meter best-suited to your particular service, you can obtain specific recommendations from one of the several manufacturers of each type of meter.

**Valve recommendations** include bronze, for ordinary service, and stainless steel where corrosive liquids are handled. Jenkins Valves made of All-Iron are also available where desired.

Jenkins Fig. 106-A Bronze Globe is especially suited for shut-off service as recommended in these hookups. The composition disc provides vapor-tight closure, and when required, can be renewed to restore valve to original efficiency.

Consultation with accredited piping engineers and contractors is recommended when planning any major piping installations.

### A CHOICE OF OVER 500 VALVES

To save time, to simplify planning, to get all the advantages of Jenkins specialized valve engineering experience, select all the valves you need from Jenkins Catalog. It's your best assurance of *lowest cost in the long run.* Jenkins Bros., 100 Park Ave., New York 17; Jenkins Bros., Ltd., Montreal. Sold through leading Industrial Distributors everywhere.

**The Orifice Type** is used, generally, to indicate, totalize and record moderate quantities of liquids, gases, or vapors. The orifice plate is the basic principle on many boiler meters and boiler combustion control mechanisms.

**The Venturi Type** meter also indicates, totalizes and records. It is frequently used in large lines, such as on condenser water supply units in power stations, water pumping stations, and sewage plants.

**The Area Flow Type** or Rotameter is for indicating, principally, in lines carrying liquids in moderate quantities.

**The Displacement Meter,** which usually totalizes only, is representative of the type used to measure the water supply from city mains to buildings. It is also employed extensively for oils, gasolines, and other liquids. Meter illustrated is fitted with a bypass for private installation exclusively. (The check valve shown prevents back flow and negative reading, and is installed only where local codes require this precaution.)

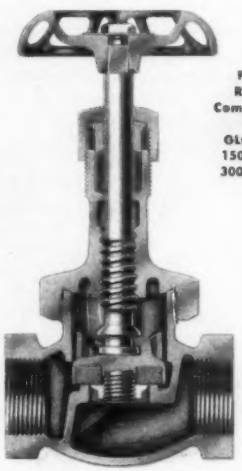
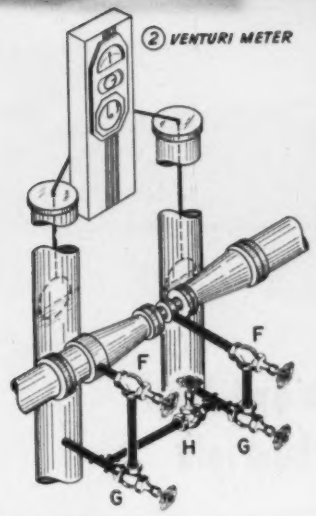
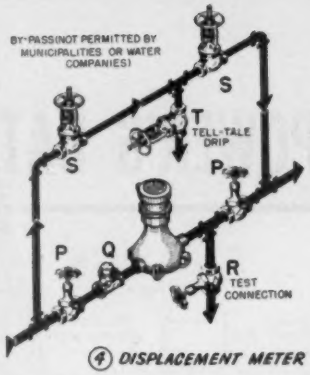
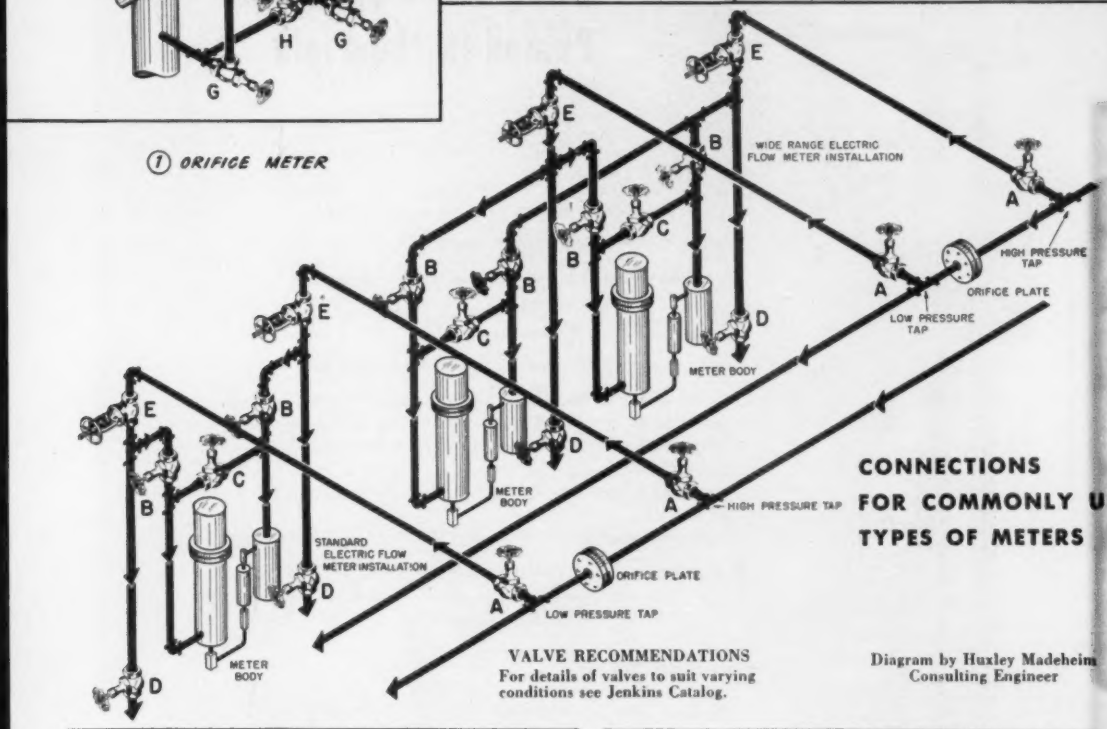


**Fig. 106-A**
**Renewable Composition Disc**
**BRONZE GLOBE VALVE**
**150 lbs. Steam**
**300 lbs. O.W.G.**






# CONNECTIONS FOR COMMONLY USED TYPES OF METERS

**VALVE RECOMMENDATIONS**
For details of valves to suit varying conditions see Jenkins Catalog.

Diagram by Huxley Madeheim
Consulting Engineer

| | Code | Quan. | JENKINS VALVES Bronze | Stainless | | Service |
|---|---|---|---|---|---|---|
| ORIFICE METER | A | 4 | 106-A | 1308 | Globe | Orifice Tap Shutoff |
| | B | 6 | 106-A | 1308 | Globe | Meter Body Shutoff |
| | C | 3 | 741-G | 1308 | Globe | Equalizing Line |
| | D | 4 | 106-A | 1308 | Globe | Drain & Blow Down |
| | E | 4 | 47-U | 1302 | Gate | Main Shutoff for Meter |
| VENTURI METER | F | 2 | 108-A | 1310 | Angle | Piezometer Tap Shutoff |
| | G | 2 | 108-A | 1310 | Angle | Tap Shutoff to Water Cock |
| | H | 1 | 741-G | 1308 | Globe | Equalizer |

| | Code | Quan. | JENKINS VALVES Bronze | Stainless | | Service |
|---|---|---|---|---|---|---|
| AREA FLOW METER | N | 2 | 106-A | 1308 | Globe | Meter Shutoff |
| | O | 1 | 47-U | 1302 | Gate | By-Pass |
| DISPLACEMENT METER | P | 2 | 47-U | 1302 | Gate | Meter Shutoff |
| | Q | 1 | 92 | 1328 | Check | Anti Back Flow |
| | R | 1 | 106-A | 1308 | Globe | Test Connection |
| | S | 2 | 47-U | 1302 | Gate | By-Pass |
| | T | 1 | 47-U | 1302 | Gate | Tell Tale Drip |

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*Illustrating the proved 3-point formula for trouble-free, time-defying hookups*

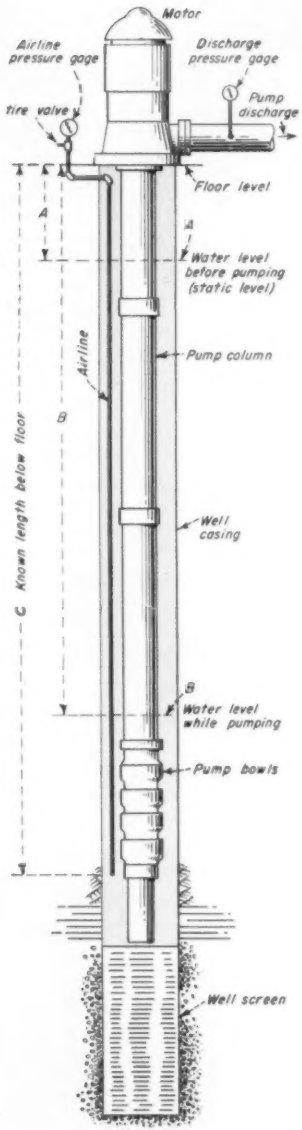
- **A** Use the right type valve for the service
- **B** Place valves correctly in the line
- **C** Choose Jenkins for lifetime economy

JENKINS
LOOK FOR THE DIAMOND MARK
VALVES
SINCE 1864
TRADE JENKINS MARK

Jenkins Bros

# POWER'S DATA SHEET

NUMBER 230




## Testing Wells and Well Pumps in the Field

*A*, water level before start of pumping = static level

*B*, water level while pumping = pumping level

*B-A*, amount water is lowered by pumping = drawdown

$$\text{Specific capacity} = \frac{\text{GPM}}{\text{Drawdown}}$$

This measures performance of well (not pump), gpm per ft.

*C*, air line of known length in ft, part of system for measuring water level. Air pumped into air line through a tire valve stem, with a hand pump, reaches its maximum stable pressure when all water is displaced through bottom, open end, of air line.

One psi of air pressure displaces 2.31 ft of water; then from known length of air line:

Distance from floor line to well-water level = $C - 2.31 \times$ air-line psig

*FH*, Field head, ft = discharge-pressure psig $\times$ 2.31 + elevation of discharge-pressure gage above floor, ft + distance below floor to well-water level, ft

$$\text{Water horsepower} = \frac{\text{FH} \times \text{GPM}}{3960}$$

$$\text{Brake horsepower} = \text{Motor horsepower} \times \text{motor efficiency}$$

$$\text{Motor horsepower} = \frac{\text{Motor kw input}}{0.746}$$

$$\text{Pump field efficiency} = \frac{\text{Water horsepower}}{\text{Brake horsepower}}$$

$$\text{Wire-to-water efficiency} = \frac{\text{Water horsepower}}{\text{Motor horsepower}}$$

*John B Murphy, Philadelphia, Pa.*

© POWER

available to solve slime problem
Santophen 45, a new Monsanto chemical, is available *now* in quantities you need to control bacterial and algal slime in cooling water. It is particularly effective in cooling waters acidified to pH 5.5 to 6.5.
With *effective* Santophen 45 readily available, you no longer have to depend upon hard-to-get chlorine, sodium hypochlorite, sodium pentachlorophenate and other slime-control agents. Used in combination with these "tight" chemicals, Santophen 45 helps stretch your supplies and gives you effective control over a wide range of microorganisms.
Santophen 45 (sodium trichlorophenate, technical) helps extend the interval between mechanical cleaning of condensers and makes cleaning easier. Santophen 45 is economical to use. It helps maintain high efficiency in cooling systems.
To adequately control slime at your plant use Monsanto Santophen 45 . . . a chemical you can be sure of getting. For a test sample, quotations and technical information on Santophen 45, contact the nearest Monsanto Sales Office or write MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1700 South Second Street, St. Louis 4, Mo.
Santophen: Reg. U. S. Pat. Off.
MONSANTO
CHEMICALS—PLASTICS
DISTRICT SALES OFFICES: Birmingham, Boston, Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Seattle. In Canada, Monsanto (Canada) Ltd., Montreal.
SANTOPHEN 45 has been used in the cooling tower at the John F. Queeny Plant of Monsanto Chemical Company for more than two years. It has been proved highly effective here and in other cooling towers with capacities up to 600,000 gallons.

SERVING INDUSTRY . . . WHICH SERVES MANKIND

# READER SERVICE SECTION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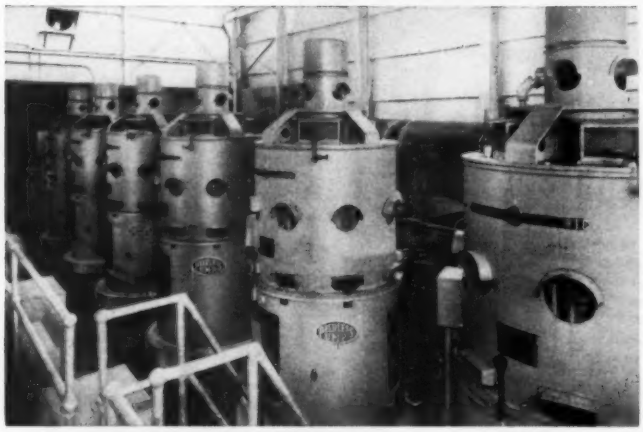
TECHNICAL BRIEFS ..... 154
PLANT EQUIPMENT NEWS ..... 158
NEW FREE BULLETINS ..... 167

**New York City Gets Emergency Water Supply**

Six 14,000-gpm, vertical, close-coupled, Peerless turbine pumps, largest of their type in the world, can discharge 20 mgd from Hudson River against 600-ft head, if needed, into City's water system. They are driven by individual 2500-hp, 900-rpm General Electric Co synchronous motors. The motor and pump weigh 27 tons

## Steel Mills Plead for Scrap

► SUPPLIES of heavy industrial iron and steel scrap are dangerously low. Several steel companies right now operate from inventories that carry less than two weeks' supply as against the 60-day level considered safe. All in all the situation is rapidly becoming a matter of national concern.

Where does general industry fit into this picture? Actually, front and center. In 1950, the steel industry purchased 29,500,000 tons of scrap from general industry. It is this supply of scrap that has fallen way off from the expected. When you realize that more than 1½ billion tons of steel are now in use in the USA, you begin to see that even a very conservative replacement program should bring back considerable scrap tonnage. Yet this year returns are not reaching the mills in quantity enough for peak production.

Oddly enough the most desirable kind of scrap, the premium heavy melting grades, come from obsolete, broken-up or discarded industrial equipment like boiler plate, engines, and other heavy machinery. Every plant has some of this class of scrap called dormant scrap. Just how much the average industrial has lying around the plant can be gaged by checking back into World War II's scrap-drive history. In one instance, Eastman-Kodak Co, 88 carloads of dormant scrap were found in the company's various plants within a 3-month period. As a result of this experience Eastman has established a set procedure for removing obsolete or unwanted equipment from inventory on a regular basis.

Steel production in 1950, the highest in history, reached 96,700,000 tons. During the first quarter of 1951 steel production was at a rate of 104,000,000 tons. By the end of the year it is expected to get up around 107,000,000 tons and by the close of 1952 total annual capacity should reach 117,500,000 tons.

For peak production, scrap tonnage should keep hand in hand with this rise in output. The 1950 tonnage of 29,500,000 gross tons should go to 32,500,000 for 1951 and as high as 35,500,000 in 1952 to maintain the desired peak.

Over 80% of the scrap consumed last year went into open-hearth furnaces. They produce roughly 90% of the industry's steel output. The charge normally going into the open hearth amounts to about 50% scrap and 50% pig iron.

It is possible to produce steel with 100% pig iron, but output per hour drops way off. Steel scrap has already been refined once. So its use again in an open-hearth furnace cuts down the time needed to make new steel since almost half of the charge is refired.

What's more, scrap serves still another function. It takes about 4 tons of coal, iron ore, limestone, and other raw materials to make one ton of pig iron. Each ton of scrap used in place of a ton of pig iron saves 4 tons of raw materials.

A big burst of enthusiasm may save the steel-production rate right now but the problem will be continuous. In less than two years the steel industry in the United States will have added more capacity than the entire steel capacity of Great Britain. This increase will cause an additional continuous demand for scrap. If the country is to make the most of the available steel capacity all industry will have to cooperate. That means making every steel user aware of the role he plays.

### Hydro Units for Old Hickory Plant

A contract for four 35,000-hp adjustable-blade hydraulic turbines has been awarded by the U.S. Corps of Engineers to the Baldwin-Lima-Hamilton Corp at a cost of about $4,000,000. In physical size these turbines rank among the largest in this country and will be installed in Old

(*Continued on page* 214)

**FOR MORE NEWS . . .**

. . . of the power field, see the items on page 214. Also, the Coming Events for this issue appear on page 214, Appointments are on page 216.

Carbon, Alloy and Stainless steel tubes are defined under CMP regulations as "controlled materials". As such, they are critical materials. Not being a mind reader, "Mr. Tubes"—your B&W Tube Company representative—needs a *close* look at the following facts in order to supply the available tubing most economically suited to your requirements.

**1** All related CMP authorizations and government contract numbers.

**2** Any acceptable alternates in type, finish, composition, and size.

**3** A brief, informative description of your intended fabricating methods.

**4** A description of the end-use, exact as to product and its service.

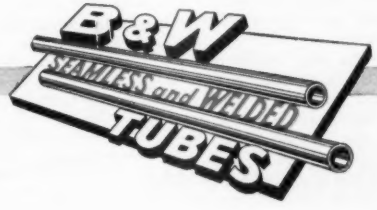
**THE BABCOCK & WILCOX TUBE COMPANY**

*Executive Offices:* Beaver Falls, Pa.

*General Offices and Plants*

Beaver Falls, Pa.—Seamless Tubing; Welded Stainless Steel Tubing
Alliance, Ohio—Welded Carbon Steel Tubing

*Sales Offices:* Beaver Falls, Pa. • Boston 16, Mass. • Chicago 3, Ill.
Cleveland 14, Ohio • Denver 1, Colo. • Detroit 26, Mich.
Houston 2, Texas • Los Angeles 15, Calif. • New York 16, N. Y.
Philadelphia 2, Pa. • St. Louis 1, Mo. • San Francisco 3, Calif.
Syracuse 2, N. Y. • Toronto, Ontario • Tulsa 3, Okla.



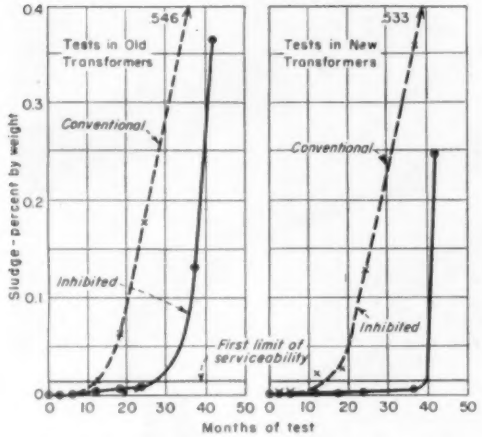

TA-1640-G

# TECHNICAL BRIEFS

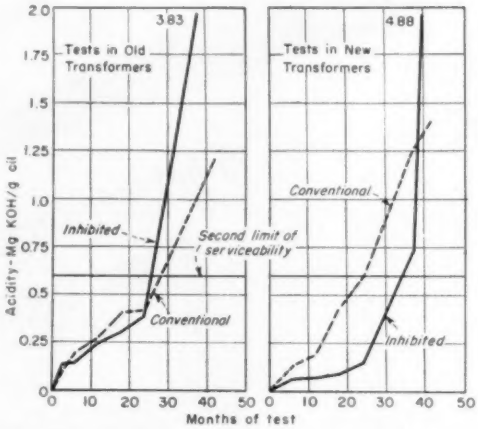
***Latest engineering developments for busy power men***

**11 digests for you on:**

**ELECTRICAL INSULATION**
**FUELS AND FIRING**
**ELECTRICAL CONTROLS**
**WATER TREATMENT**
**PIPING AND TUBING**




**1** Because expected loadings will increase oil changes, comparison tests are run for conventional and inhibited oils




**2** Limits of serviceability for transformer insulating oil, *horizontal lines*, show relative inhibited oil life for new, old units

## Electrical Insulation

APPLICATION OF CLASS-H INSULATION TO TRANSFORMERS, *by Melvin L Manning, Pennsylvania Transformer Co.* Thermal endurance of insulating material is a major limitation of electrical equipment. For reasonable life, this equipment is designed to keep its maximum operating temperature within the thermal limits of the insulating material. Both industrial and utility engineers have long awaited an ideal dry-type transformer whose insulation would have a balance of properties—heat stability, good electrical properties, high moisture repellency, fire and explosion resistance. Class-H insulation, now in volume production, comes closest to these objectives. This paper reviews the kinds of Class-H insulating material recently developed and the evaluation of its use in transformers.

This insulation may consist of inorganic materials, such as glass, porcelain, mica and asbestos, bonded or impregnated by silicone resins or rubbers or by the fluorocarbons. The difference compared with Class-B insulation lies in the resins and varnishes used as the bonds and impregnants. Exposed to air, Class-H insulation has about 100 C temperature advantage.

Uppermost question on the new insulating material as it applies to transformers is the selection of a "hottest spot" temperature and also evaluation of its dielectric properties. The author discusses several methods for their determination.

Cost of Class-H silicone insulation runs about 20% more at present than organic phenolic varnish bonded insulation. But reductions in cost are being made continually, and as the use of silicones increases the cost will probably decrease accordingly. Costs of Class B and Class A insulated wire are now similar. *AIEE paper No. 51-264.*

INHIBITED OILS FOR TRANSFORMERS, *by Herman Halperin and H A Adler, Commonwealth Edison Co.* Insulating oil plays an important role in the operation of electric-utility equipment, but its cost represents only a minor portion of the total investment in equipment. For instance, for each kw of generating capacity in the authors' system they use only 2.4 gal of insulating oil, not counting oil in cable systems. Cost of oil in transformers, circuit breakers and regulators amounts to only about 2% of total installed for other equipment.

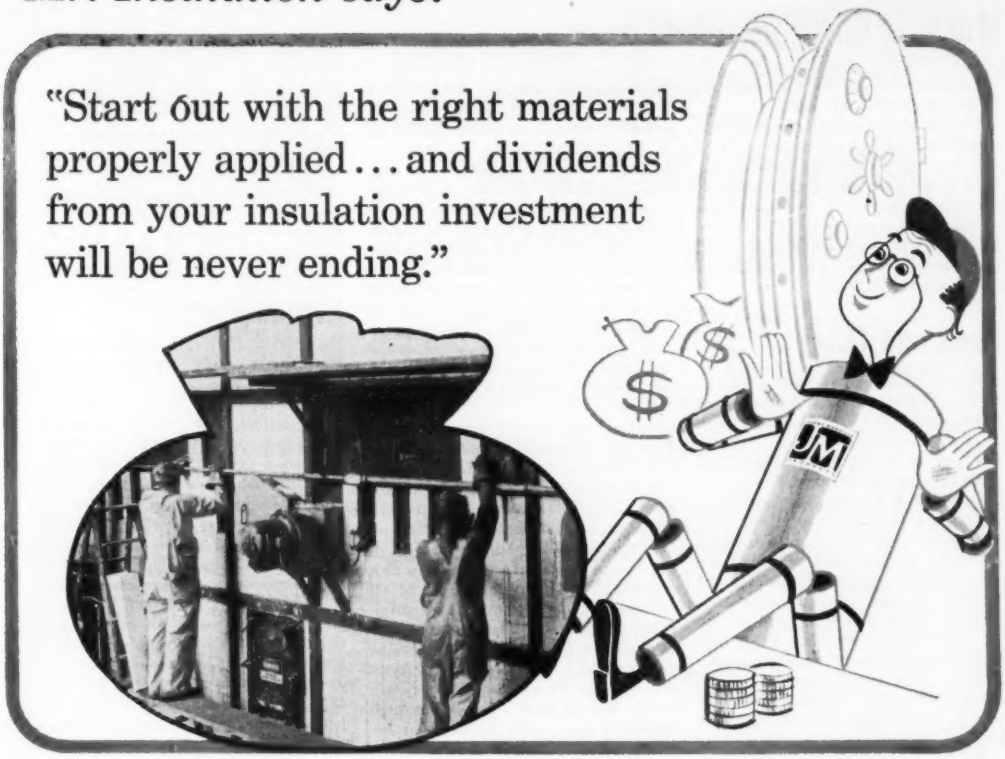
But because this oil is so important to the performance of relatively expensive equipment, continued efforts have been made over the years to improve the oil. It is estimated that with the 1930 loading, average oil life was 10-15 years in unprotected transformers (those where air is in direct contact with oil in the transformers). It was further noted that when change of oil was needed, because of deterioration in service, life of the replacement oil was much shorter; sometimes only half as long as the original oil. This was due probaby to residual deterioration products in the installation, which could not be removed when oil was replaced.

So when inhibited oils became available in 1946 for transformer service there was considerable interest in their application and performance possibilities. The feeling existed that some inhibited oils would deteriorate rapidly once the inhibitor had been expended. Fig. 1 and 2 bear this out. Yet this is no reason for concern now since the oil

*Directions for ordering papers are given on page 156*

## *Mr. Insulation says:*

"Start out with the right materials properly applied... and dividends from your insulation investment will be never ending."




Here are two important reasons why it will pay you to let Johns-Manville serve as your insulation headquarters:

YOU GET THE RIGHT MATERIALS — Regardless of the service conditions on your job, Johns-Manville has an insulation that fits the need. That's because Johns-Manville manufactures a wide variety of insulations of asbestos and other selected raw materials—for service from 400F below zero to 3000F above. Johns-Manville offers this complete line because industry requires many types of insulations and because no one material can properly serve as a jack-of-all trades for use on all jobs.

YOU GET THE RIGHT APPLICATION— Insulations serve at top efficiency only when properly applied. J-M Insulation Contract Firms have men with generations of insulation experience and training in Johns-Manville application methods. The way they engineer your job is your assurance that your insulation investment will pay a high return through the years.

Why not call on insulation headquarters for engineering advice about your insulation work. J-M Insulation Engineers are available to help select the *right* insulation for your particular service conditions. Write Johns-Manville, Box 290, New York 16, N.Y.

JM PRODUCTS

**Johns-Manville** *first in* **INSULATIONS**

# More TECHNICAL BRIEFS

Begins on page 154

is not allowed to remain in transformers to this stage of deterioration.

The authors discuss various tests to which the inhibited oil has been placed and experiences resulting from its use. Data in the tables and figures given by the authors support the feeling that life of the inhibited oil is twice that of conventional oil in old transformers and three times that in new transformers. *AIEE paper. No. 51-208.*

## Fuels and Firing

METHODS OF REDUCING DUST EMISSION FROM A SPREADER-STOKER-FIRED BOILER FURNACE, *by W C Holton and R B Engdahl, Battelle Memorial Institute.* Because of the spreader stoker's advantages—an ability to burn coal of a wide range of size and type, quick response to load changes, relatively light maintenance—its use has increased greatly in the past few years. At the same time, though, that spreader-stoker installations have become commoner, more attention has been paid to the subject of air pollution and its control. Public demands for smoke abatement and dust nuisance, no matter what the source, have been directed frequently toward fuel-burning devices like the spreader stoker.

Little actual information has been available on the amount and method of reducing carryover from spreader-stoker-fired boilers. To get this information, a special research committee was formed in 1948 by a number of leading stoker manufacturers. And a number of tests were run at the Brown-Lite-Chapin Division of General Motors Corp in Elyria, Ohio.

The following factors were investigated. (1) over-fire air and cinder reinjection, singly or combined (2) over-fire air percentage (3) steam jet (4) steam air jet (5) location of steam jet (6) partial and total reinjection (7) coal size.

The authors describe the test plan, the apparatus involved, and show a sectional drawing of the boiler under test; the procedure, and the calculations involved, as well as the test results.

The most significant results are: (1) Jet turbulence, whether from steam or air, is needed to give the low smoke densities required by municipal ordinances. Further, over-fire jets reduce carbon loss and dust emission from the furnace. (2) Reinjection of cinder from boiler hoppers decreases carbon loss 2.3 to 4.1 percentage points, but it increases dust loading from 20 to 40%. Returning all collected cinder from both boiler and collector hoppers gave a further decrease in carbon loss of 2.1 to 2.8 percentage points, but, again, at an expense in increase of dust loading of 125 to 155%. (3) Use of coal containing a small percentage of $-\frac{1}{8}$-in. particles gave lower values of carbon loss and dust loading at the furnace outlet than were found with finer coals, but in no case was the dust loading at the boiler outlet reduced enough by burning double-screened coal to allow the plant to meet a proposed smoke ordinance without a dust collector. *ASME paper No. 51-SA-20.*

PATTERN FOR SOUND FUEL PROCUREMENT, *by Marshall Pease Jr and R J Brandon, Detroit Edison Co.* The combined studies of a production department load committee and the controller's office produce accurate predictions of coal requirements for any given year of the company's plant operations. This prediction is divided into needs of all individual power plants and central-heating plants. It determines quantity and quality for plants whose specific fuels vary with type of equipment. As an indication of the accuracy of prediction in the Detroit area, which has a high industrial load, early estimates of annual coal consumption usually result, at the end of the year, within 4 or 5% of the original plan.

At any time, the coal-supply factor must be made secure. This is particularly true in utility fuel. There are always extreme quantities of so-called "bargain" coal available during the buyer's market and they must be considered only as a means of averaging down over-all price, rather than as a steady and dependable supply source. *Mich. Combustion Conference paper. No number. Univ of Mich., Ann Arbor.*

### TO OBTAIN COMPLETE TEXT

*Material for these abstracts comes from one of the following sources unless otherwise stated. Order complete paper from source, not from* POWER.

*Midwest Power Conference, Sherman Hotel, Chicago, Ill. April 2-5, 1951. Identified by initials MWP. Obtainable in proceedings. Inquire R A Budenholzer, Illinois Institute of Technology, 3300 Federal St, Chicago 16, Ill.*

*American Society of Mechanical Engineers, annual meeting, Statler Hotel, New York City, Nov 26-Dec 1, 1950, semiannual meeting, Royal York Hotel, Toronto, Ont., Can. June 11-15, 1951. Identified by initials ASME and obtainable through ASME, 29 W 39th St, New York 18, N. Y.*

*American Institute of Electrical Engineers, summer general meeting, Royal York Hotel, Toronto, Ont., Can. June 25-29, 1951. Identified by initials AIEE and obtainable through AIEE, 29 W 39th St, New York 18, N. Y.*

## Electrical Controls

PROTECTIVE RELAYING ON INDUSTRIAL POWER SYSTEMS, *by C M Lathrop and C E Schlecker, Standard Oil Development Co.* An emergency outage such as a power failure at any process unit in a continuous processing operation affects the smooth flow of material to all other elements in the process. Yet the trend of many industrials, such as petroleum, chemical plants, is toward just such an operation. Along with it has come the trend toward complete electrification of the prime movers at the processing unit. It is increasingly important, then, that electric power supply be reliable and uninterrupted. Power supplies in modern installations are therefore usually of the dual-speed type wherein two full-capacity supplies are provided at the battery limit. Yet the duplicate equipment alone will not assure a reliable power supply unless the equipment is properly coordinated by power-system relay.

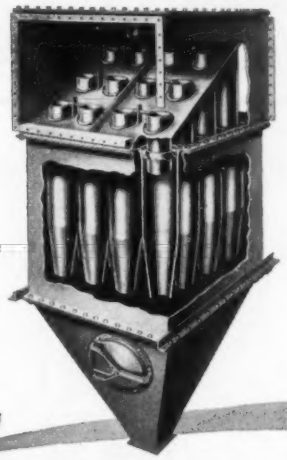
Relaying on a modern industrial plant's power system is a compromise between (1) close protection of electrical equipment, that is, motors, transformers, cables, wherein faulted circuits and equipment are disconnected from the power system in the shortest possible time and overload protection is paramount (2) power system coordination where short circuits cause the minimum power system outage.

The authors' experience indicates that the second job of relaying equipment, that is, power system coordination, is of much more importance than the first. As an example of poor relay coordination, they cite a short circuit on a motor feeder that would cause the main circuit breaker to trip instead of the motor feeder breaker, with loss of the entire bus load.

Many examples have been found where the relaying was originally coordinated on the power system, but with the growth of load or generation feeding of the system, the relaying was no longer coordinated. The authors feel that relaying is determined by the dis-

(*Continued on page* 188)

**Before you buy *any* equipment for recovering dust or fly ash . . .**



# COMPARE ALL OTHERS against MULTICLONE'S Multiple Advantages

**Because the advantages of MULTICLONE are so clear-cut, so vitally important, so far-reaching in the savings they make, we urge you to make a factual unbiased comparison of MULTICLONE dust and fly ash collection equipment against *any other* in the mechanical recovery field. Only by making such a comparison can you fully appreciate the major savings and greater performance you get by installing MULTICLONE Collectors!**

## COMPARE Recovery Efficiency!

It is a recognized fact that the separating efficiency of a cyclonic tube *increases* as the tube diameter *decreases* because smaller tubes generate greater centrifugal forces. The patented vane in the MULTICLONE makes the use of small tubes *practical* without complicated manifolding and permits compacting many small tubes into one simple, highly efficient unit. MULTICLONE's higher centrifugal forces throw out not only the large, medium and small particles, but also an unusually high percentage of the *extremely small* particles of 10 microns and less. Result—*more complete recovery of all suspended particles from the gas stream!*

## COMPARE Space-Saving Compactness!

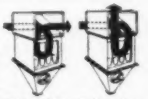
Plant space costs money—particularly at today's high construction costs. Because the MULTICLONE is more compact, size for size, it makes *really important* savings in space and plant costs. Note in the chart how the MULTICLONE requires substantially less space—*both in floor space and cubic space*—than any other unit of comparable capacity and performance. *This means vital savings in construction costs!*

| Make | Relative Space Requirements In Sq. Ft. | In Cu. Ft. |
|---|---|---|
| Multiclone | 1.0 | 1.0 |
| Collector A | 2.1 | 1.8 |
| Collector B | 5.9 | 3.2 |
| Collector C | 6.8 | 3.9 |

## COMPARE Dollar-Saving Adaptability!

Savings in space is just one of many ways MULTICLONE reduces installation costs. Because the shape of the unit can be readily varied (long and narrow, short and wide, or square) to fit available spaces, the MULTICLONE can often be tucked into odd corners and waste areas too restricted for other equipment.

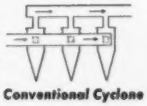
Moreover, inlet-outlet ducts can be varied—side-inlet side-outlet, or side-inlet top-outlet—to meet low headroom or restricted side clearance requirements . . . and the single-inlet single-outlet duct design permits greater flexibility and simpler installation. *These all add up to vital savings in installation costs!*



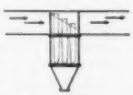
**Side inlet, Side outlet** **Side inlet, Top outlet**

## COMPARE All-Around Simplicity!

The MULTICLONE is simple and inexpensive to maintain because there are no highspeed moving parts to repair or replace . . . no pads or filters to clean or renew . . . nothing to choke the gas flow or increase draft losses as suspended materials are recovered. In addition, the square, flat-sided shape of the MULTICLONE and its straight inlet and outlet ducts are far simpler to install and insulate. And since the recovered material from an entire bank of tubes is collected in a *single* hopper, it is much easier to service and maintain than the multiple hoppers of conventional cyclone units. *Here again, the* MULTICLONE *saves in many ways—all of them important!*

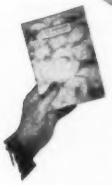


**Conventional Cyclone**



**Multiclone**

**Whether your recovery installation is in a new structure or for modernizing present equipment, you will be far ahead by installing MULTICLONE Collectors. Our experienced engineers will gladly make helpful suggestions for simplifying your recovery problems. A letter, wire or call to our nearest office places this assistance at your service without obligation.**



**Send for Helpful Literature!** This factual MULTICLONE literature explains the basic principles of cyclonic dust recovery and gives technical data helpful to anyone contemplating a dust or fly ash recovery installation. Write today for your free copy!

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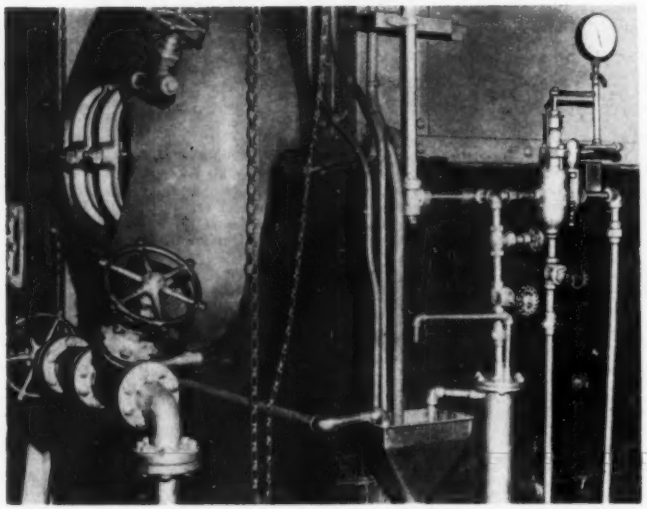
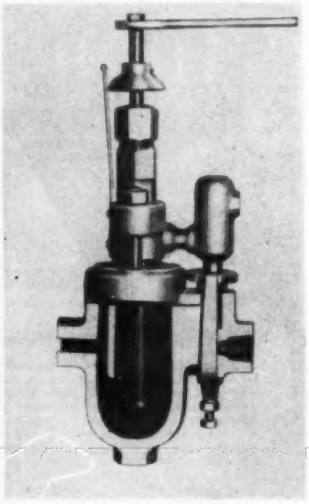
# PLANT EQUIPMENT NEWS

***Your information center for new products designed to solve plant problems***

Published monthly as a service to readers



**1** Installation of *K-Master* continuous blowdown valve, *upper right*, shows small space occupied by unit. Valve is easily dismantled for maintenance, overhaul



**2** Cutaway of continuous blowdown valve shows strainer, flash chamber

## Continuous Blowdown Valve Stops Hit-or-Miss Boiler-Water Control

**P839** • Hit-or-miss manual intermittent blowdown of a boiler can be wasteful and dangerous. The *K-Master* continuous boiler-blowdown assembly was designed and engineered in a large industrial power plant that operated many years using various methods and devices for blowdown. All proved unsatisfactory because severe flashing of hot, dirty blowdown loaded with impurities either destroyed them or plugged valve ports, eroded valves and seat or clogged pipes. Maintenance costs were high.

Consisting of a strainer, variable and fixed orifices contained in one unit, the *K-Master* valve operates like this. Concentrated hot boiler water enters at left, Fig. 2, and is deflected by the vertical baffle before passing through the monel screen. Large particles of dirt and pipe scale are caught by screen. From the strainer water flows vertically upward to an adjustable orifice. Leaving orifice it goes to a flash chamber at the right in Fig. 2. Fixed orifice at flash-chamber outlet causes a pressure to build up in chamber. For any setting of adjustable orifice there is a corresponding pressure in chamber. Also, there is but one blowdown rate for each pressure that may exist in chamber. So by connecting a pressure gage to chamber, blowdown rate is easily found. To assure proper orifices for each condition, every valve is sized individually. Blow-off connected to valve bottom removes sediment.

*K-Master* valve is quickly dismantled wtihout breaking piping connections by simply removing two nuts. Bodies for 250-psi valves are semisteel with stainless-steel trim, standard tapped for ½- or ¾-in. pipe. For higher pressures, bodies are all steel; same trim. **Kaye & MacDonald, Inc, 11-15 Central Ave, West Orange, N. J.**

### STANDARD WRENCHES P835

Complete line of company's standard *Proto* box wrenches, open end, and combination box-and-open end, were redesigned to improve efficiency, appearance, and ease of handling. For instance, the open end wrenches have narrower jaws to reduce the width of the pear-shaped heads and permit work in closer quarters. The edges of the shank have been well rounded and given a smooth flat surface.

**Plomb Tool Co, Washington & Sante Fe, Los Angeles 54, Calif.**

For more data on these items, use post cards, p167. Identify request with P and number.

### DUSTFALL COLLECTOR P862

A directional dustfall collector provides an index of the general location of plants putting forth heavy dust materials into the air. The instrument is so set up that it collects dirt and dust from any direction the wind is blowing.

**Eberbach & Son Co, Ann Arbor, Mich.**

### *And Next Month . . .*

High-pressure sanitary pump that runs by "breathing." Operating mechanism is hermetically sealed from pumped liquid. Parts touching liquid are stainless steel.

### METAL ALLOYS P802

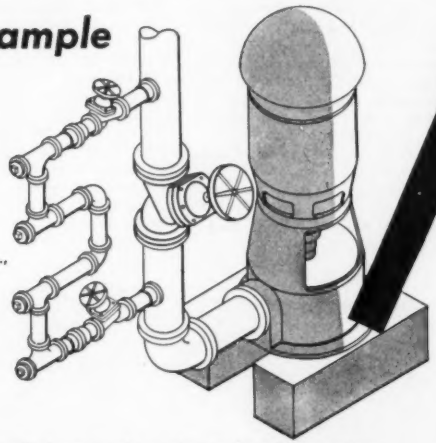
New metal alloy suitable for dry bearings, precision castings, fluxless weldings, results from bringing together molten metal plus an alloying of a wet chemical mass. The result, *Chemalloy*, defies rust and resists corrosion. It is said to work without lubricants in moving machines or parts and to remain relatively cool while being lathe-turned. All possible uses for *Chemalloy* have not yet been explored.

*Chemalloy* pertains to a family of metals reclaimed from melting down old metal pieces such as carburetors, fuel pumps, radiator grills. It is basically *Chemalloy* zinc but has many properties beyond those

# for outstanding service

## on Corrosive Well Water

## ...for example



The Installation—
Barr Rubber Products Co.,
Sandusky, Ohio

**PROBLEM:** To eliminate costly seating and packing maintenance, and frequent replacement of valves on plant well-water pump. Valves previously used highly unsatisfactory, having maximum life of 6 months.

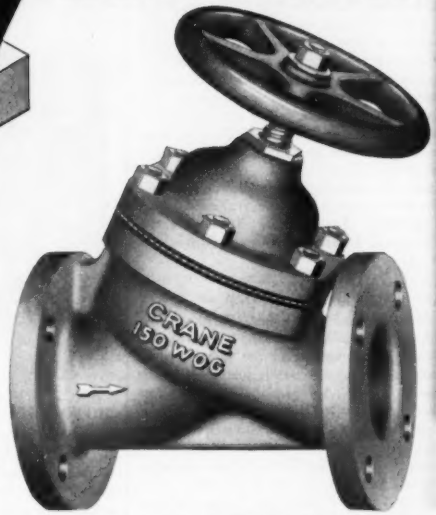
**WORKING CONDITIONS:** Sulphur content of water extremely high. Valve constantly exposed to severe corrosive and erosive effects. Operated infrequently; yet easy operation, positive seating are prime requisites.

**SOLUTION TO PROBLEM:** Crane Packless Iron Body Diaphragm Valves featuring separate disc and diaphragm design. Three-inch No. 1611 flanged end valve on main discharge; ¾-inch No. 1610 screwed end valves on by-pass.

**RESULT:** While other valves lasted only 6 months or less, Crane Diaphragm Valves show no effects of service, after more than a year. They operate smoothly . . . seat tightly . . . no maintenance whatsoever needed to date!

**Another typical demonstration of superior quality, and the low-cost performance of Crane Valves. That's why . . . More CRANE VALVES are used than any other make!**

## ...Choose Dependable CRANE VALVES




**No. 1611 Crane Iron Body Diaphragm Valve —one of a full line suited for many services. Literature on request from your Crane Branch or Crane Wholesaler.**

# CRANE CO.

*General Offices:*
836 S. Michigan Ave., Chicago 5, Ill.
*Branches and Wholesalers Serving All Industrial Areas*

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of zinc alone. Manufacturer states it has the slightly magnetic characteristic of zinc, machines and saws readily, has a damping capacity rated as fair, a 92 Brinell hardness, or 60 Rockwell B, and a tensile strength of about 50,000 psi, and a compression strength of 100,000 psi.

**Chemalloy Associates, Gillespie Airport, Santee, Calif.**

### SPECIALTY CAPACITOR P803

Development of a new, low-temperature *Pyranol*, a proprietary insulating oil, permits the use of specialty capacitors at temperatures down to –2 C. Specialty capacitors in this service show no loss in capacity, which means the same unit can be used not only for high and low temperatures, but also for indoor and outdoor applications.

The use of this development in capacitors, for such applications as motors and fluorescent ballasts, means the cold weather uses of these devices are greatly extended.

**General Electric Co, 1 River Road, Schenectady 5, N. Y.**

### ALL-USE THERMOMETER P816

Corrosion-resistant, stainless-steel case houses a new thermometer, TAG model 8689, for use in any area regardless of weather or other conditions. The thermometer has a large, clear, easy-to-read scale and can be obtained in five different types, ranging from as low as –40 F to as high as 400 F. The arched bows and flanged edges of the case give the widest possible angle of vision and insure maximum air circulation for true value readings.

**Tagliabue Instrument Div, Weston Electrical Instrument Corp, Newark 5, N. J.**

### ANTICORROSIVE AGENT P817

New anticorrosive agent, *Corrosanti*, in four grades, is a boiler and metal protective, which reacts upon the metal treated and not upon the water surrounding the metal. *Grade A* is for boiler metal surfaces, and *B* is for the protection of ferrous metals subject to deterioration from water and water vapor. *Grade C* is designed to protect surfaces subject to acids and other highly corrosive vapors and gases. *Corrosanti Special* is meant for ferrous surfaces subject to temperature of 900 F.

**Dr Albert Schor, 32 Cambridge St, East Orange, N. J.**

### STOKER FEEDER P826

Slow-speed, 16-ft screw conveyor, ruggedly built, will supply fuels, including coal, wood chips, hog wood, or sawdust, for stoker service in steam-generating boilers.

**American Coal Burner Co, Inc, 18 (B) East Erie St, Chicago 11, Ill.**

For more data on these items, use post cards, p167. Identify request with P and number.

## ELECTRICAL DEVICES FOR WIRING AND MOTOR CONTROL

### WIRE TERMINALS P805

Effective and economical method of avoiding short-circuit risks between closely spaced wires is claimed for the manufacturer's self-insulated *Sta-Kon* terminals. They are integral one-piece assemblies that combine a metallic grip on wire and its insulation with a single staking operation. Terminal is insulated with nylon.

Chief advantages are said to be longer electrical creepage path, a positive anchoring of the insulator, a deep socket for wire insulation.

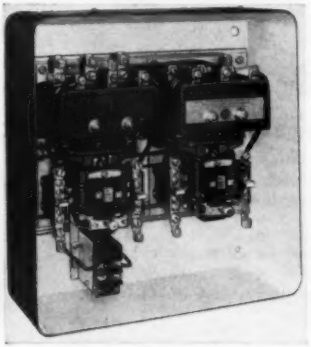
**The Thomas & Betts Co, Inc, 46-A Butler St, Elizabeth, N. J.**

### VOLTAGE REGULATOR P806

Redesigned line of single-phase voltage regulators in standard ratings of 9.6 to 24 kva widen the field of application for economic uniform voltage control with small regulators. They are available for single-phase circuits, 600 v and below, up to 1000 amp.

With standard controls, the single-phase *Inductrols* can be used for secondary circuit regulation where lighting and power are supplied on the same line in mills, factories and large offices.

**General Electric Co, 1 River Road, Schenectady 5, N. Y.**



### MOTOR STARTER P808

New ac part-winding-starter consists of two across-the-line starters and a pneumatic timing mechanism mounted below one starter and operated by the operator's solenoid plunger. Pressing the start button closes the first starter and energizes one of the two parallel windings. Meanwhile, the timer goes into operation, after a few seconds energizes the second starter. With both starters closed, full-line current is supplied to the motor through both windings, each using 50% of the total current drawn.

Use of part-winding-starting does not produce objectionable current surges obtained with autotransformer starting because the motor is not disconnected from the line during the starting period. This device is for motors employing two separate parallel windings, star or delta, to obtain increment starting.

**Allen-Bradley Co, Milwaukee 4, Wis.**

### FRACTIONAL-HP STARTER P857

Class 2510 Type A fractional-hp manual starter, designed to control and protect single-phase ac and dc motors of 1 hp and less. Both single- and double-pole devices are available. Starter incorporates dependable, trip-free overload protection, which gives a definite trip indication.

Three types of enclosures are available as well as the open-type starter: general purpose (NEMA I), water and dust tight (NEMA IV and V), and explosion-resistant (NEMA VII and IX). The attractive general-purpose enclosure is die-cast aluminum and can be supplied with a pilot light for 115- and 230-v operation without increasing over-all dimensions.

These units are well suited for general use around the plant for switching and protection of fractional-hp motors.

**Square D Co, 4041 N Richards St, Milwaukee 12, Wis.**


(*Continued on page 162*)

# Perhaps we can give YOU a HELPING HAND

● Under present conditions we cannot always give you all the materials you require. But we can give you plenty of help through Revere's Technical Advisory Service. And, our colleagues in American business tell us it's a worthwhile aid, too. We have been rendering this service for many years, and it is backed by a wealth of knowledge accumulated over a century and a half of working with metals.

So, with your problems on the increase, as whose aren't these days, why not check us on what's bothering you and see if we can't help. We are already helping others regarding the usage, to their best advantage, of the products they *can* get.

Since two or more heads can produce more right answers than one, let's get together. You can get in touch with the Revere Technical Advisory Service through the Revere office nearest you.

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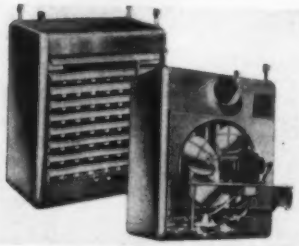
# More EQUIPMENT NEWS

Begins on page 158

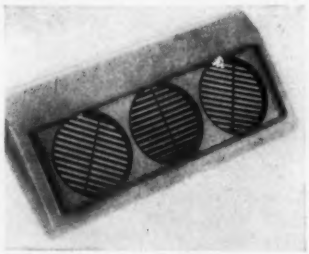
## HERE ARE 3 ITEMS THAT MAY FIT INTO YOUR HEATING AND AIR-CONDITIONING PLANS



**UNIT HEATER** **P824**

Gas-fired unit air heaters including fan blower and duct-type models with sheet-steel and cast-iron heat exchangers are designed for use with natural, manufactured, mixed, or propane gas. Heaters are housed in heavy-gage steel cabinets. All heat generated by the burning gas goes directly to the heat exchanger and then to the circulating air. The *Series 22* are available in the fan type in ranges from 55,000 to 200,000 Btu per hr. *Series 20*, with cast-iron heat exchangers, come in capacities of 100,000 and 135,000 Btu per hr.

**United States Air Conditioning Corp, 3300 Como Ave, Minneapolis 14, Minn.**



**WINDOW CONDITIONER** **P821**

Fingertip control of cooling air features window air conditioner employing a 5-piece plastic assembly. These five pieces fit together to form the entire front of the conditioning unit, which measures 26 in. long by 12 in. wide. Three disks, with louvers set at a 45-deg angle and held in place by spring clips, mount in the front panel. These disks can be adjusted with the finger tip to distribute air in any desired direction.

Eye-appeal was kept in mind during the design stage; the assembly is styled in three shades of tan.

**General Electric Co, 1 River Road, Schenectady 5, N. Y.**

**DEHUMIDIFIER** **P815**

Plug-in type dehumidifier *Model DMS 4*, powered by a hermetically sealed compressor with a permanently lubricated fan motor, has an aluminum evaporator coil with extended surface. The condenser uses finned copper tubing. It can handle air flows up to 100 cfm in a compact packaged unit that measures 17 in. long, 13 wide, 15½ high. It uses 115-v 60-cycle, 2 amp.

Dehumidifier works on the principle of an electric refrigerator. The moisture-soaked room air is drawn into the dehumidifier by a fan inside it. This air then passes over the cold coils.

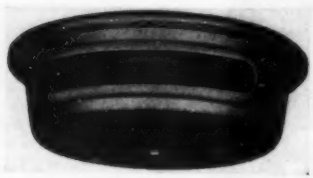
**Abbeon Supply Co, 58-10—41st Drive, Woodside, N. Y.**

**ELECTRICAL CONTROL** **P827**

A resonant electrical circuit somewhat similar to a constant-voltage transformer involves three windings—a primary, a secondary, and a relay coil in series with a capacitor, which comprise the resonant circuit. The magnetic circuit consists of a closed core provided with a magnetic shunt.

When low-voltage ac is applied to the primary very little of the flux generated cuts the secondary because of the loose couple. By controlling the magnetic circuit reluctance, the secondary voltage can be closely controlled. The *Sensivolt* is said to respond to changes as small as ½ v. It can be used to give remote operation of auxiliary power equipment at isolated stations or to protect motors and other electrical equipment against high or low voltage.

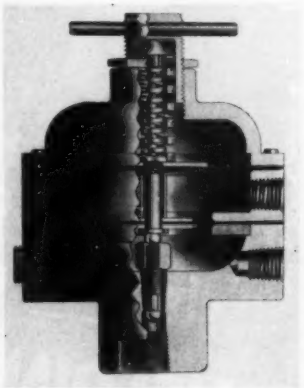
**Sola Electric Co, 4633 W 16th St, Chicago, Ill.**



**AIR DIFFUSER** **P809**

High-pressure air diffuser, *Type HPC II*, handles air at high pressures and high velocities, permitting unusually small exposed ducts of uniform size. A smaller volume of air at low temperature provides a cooling effect ordinarily supplied by a greater amount of air at higher temperature. Performance data, drawings and installation views are described in a bulletin K-26.

**W B Connor Engineering Corp, Shelter Rock Lane, Danbury, Conn.**

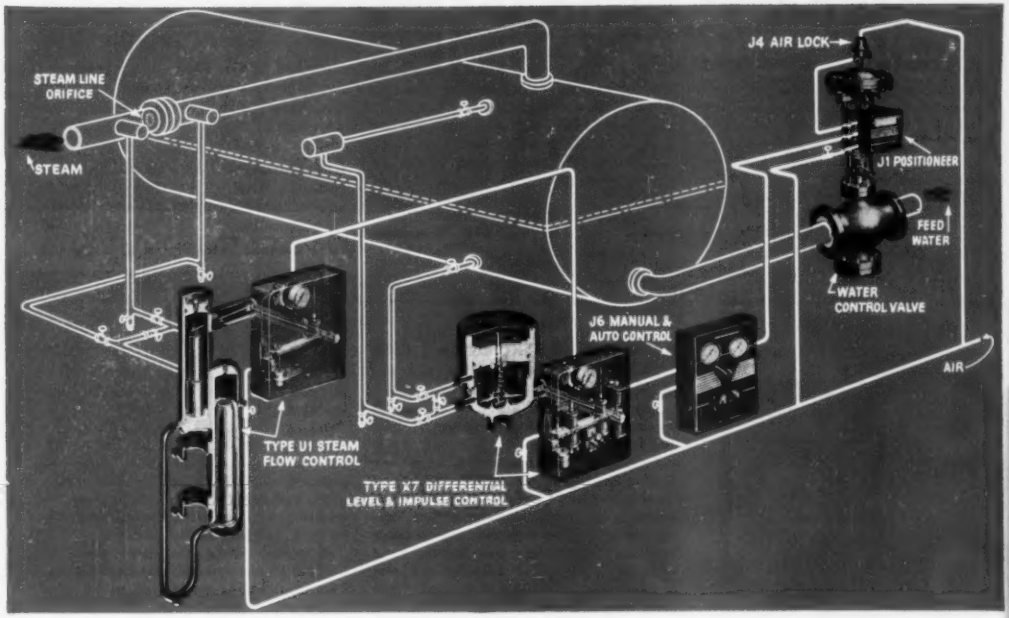


**REVERSE-ACTION RELAY** **P838**

*Type 228* reverse-action relay is designed with bronze case, top and non-wearing parts. Ratio plates, inner valve and seats are stainless steel with diaphragms of nylon-inserted neoprene. Maximum pressure output at minimum pressure input from pilot or other controlling source, or vice versa, is obtained without modifications in either valve or pilot hookup. This relay can be used on large single-seated valves where positive shutoff is required, pressure drops are high, and conventional

For more data on these items, use post cards, p167. Identify request with P and number.

# Swartwout Impulse Regulation assures correct feed water supply under any load condition




SWARTWOUT two-element controls—by utilizing the very forces that cause false drum level—produce a corrective impulse that assures correct level even under rapid load swings. Since "shrink" and "swell" are functions of *rate of change*, as well as magnitude of load, only Impulse Regulation gives satisfactory operation under *any rate of change in load of any magnitude.*

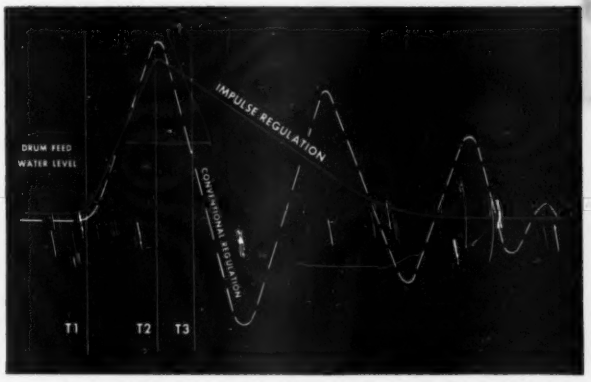
Type U1 flow transmitter takes square root of steam line orifice differential and feeds airloading pressure, which is directly proportional to steam flow at all flows, to X7 differential level and impulse control. X7 unit positions flow valve by sending airloading pressure which is result of combining *rate of change* of steam flow function with water level.

Graph *(right)* shows how proper combination of these forces, plus reset and setback features, assures that valve will give desired operation under *any* load condition. System can be adjusted to maintain drum level constant at all loads, carry it high at high loads, low at low loads, or vice versa. In addition to this FW6 two-element system, Swartwout also makes an FW7 three-element impulse regulating system. Other types include FW5 single-element system and SC (FW1) thermo-hydraulic system.

A-3753

**Swartwout**

**POWER PLANT EQUIPMENT**




SEND FOR BULLETINS S-27, S-20-E • THE SWARTWOUT COMPANY, 18511 EUCLID AVENUE, CLEVELAND 12, OHIO

# More EQUIPMENT NEWS

Begins on page 158

spring-loaded diaphragm-actuated topworks are large and cumbersome. Many other applications are also possible.
**Black, Sivalls & Bryson, Inc, 7500 E 12th St, Kansas City 3, Mo.**

### STEAM CONTROL P863

Sensitive, accurate regulation of steam pressure on any stoker, gas- or oil-fired. Boiler can be had with Model SC-B, master regulator, installed in conjunction with a *Lectricarm* drive unit. A spring-loaded bellows operates a floating contact assembly to modulate fuel feed in proportion to pressure and load changes.
**Cleveland Fuel Equip Co, 7316 Associate Ave, Cleveland 9, Ohio.**

### WATERCOOLER P869

Welded-steel, engine-jacket watercooler gives rugged service that resists vibration so cooler unit can last the life of the engine. It has heavy formed-steel channel side members, steel side supports for cores, press-formed heavy-weight nonferrous headers and a vertical water flow. Gas or lube-oil cooling coils may be mounted between fan and liquid cooling core. Then the blower cools the oil or gas cooling coils, or both, with the least rise in air temperature so cooling effect of the air stream over the liquid core is not too greatly affected. Such a combination gives a lower fan-horsepower requirement.
**Young Radiator Co, 610 Wisconsin Ave, Racine, Wis.**

## *Flip a Few Pages Ahead And Check These Too . . .*

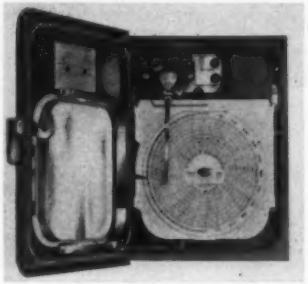
**Control Valve** for air and bulk materials. Flexible diaphragm made of cotton, duck, nylon or rubber. ..... p 172

**Electrical Male Plug** with spring-type blades insuring positive connection. ... p 174

**Gas Safety Valve,** really a combination safety and plug valve that fails "safe" ..... p 174

**Line Starter** for machine tools. Starter enclosure, NEMA Type 12, has no knockouts or mounting holes in the box itself. ..... p 178

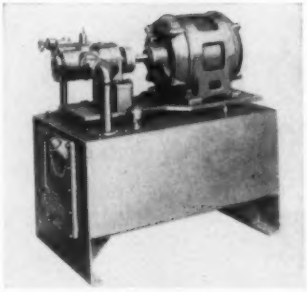
**Tube Cleaner** weighing but 15 lb. ... p 178



### RECORDING INSTRUMENTS P856

Line of recording voltmeters and ammeters known as "Series 500" electric recorders. Instruments make a continuous record of voltage or current on an 8-in. circular chart.

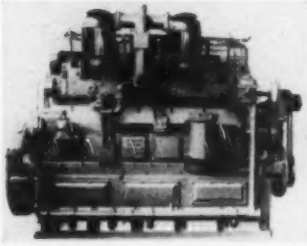
Series 500 instruments feature a new moving-iron measuring mechanism having shock-protected precision stainless-steel bearings, magnetic damping, and a locking device to prevent damage due to rough handling. Instruments are housed in a compact die-cast aluminum alloy case that is moisture-, fume-, and dust-proof. Complete information in Bulletin E1111.
**The Bristol Co, Waterbury 20, Conn.**



### HYDRAULIC-POWER UNITS P873

New line of hydraulic units is constructed according to recommended hydraulic standards for industrial equipment. These include a motor-driven rotary pump mounted on a sealed oil tank with breather air cleaner and separate filler hole with removable screen. Elevated tank body has dished bottom, drain plugs, and clean-out holes at both ends.

These units are available in sizes for electric motors of ¾ to 25 hp. They use single- double- and two-pressure pumps up to 1000 psi, and two-stage for 2000 psi.
**Vickers, Inc, 1596 Oakman Blvd, Detroit 32, Mich.**



### NATURAL-GAS ENGINE P850

Model LR-600-GAS engine is a medium-speed unit 1100 rpm designed for oil-producing areas. Municipal power plants, pipeline pumping stations, oil-well drilling rigs and cotton gins are a few specific applications for this unit. It is a 6-cyl spark-ignition engine with 7¼x10-in. bore and stroke. Maximum rating is 315 hp. Unit is fitted with a gas carburetor, mixing valve, magneto and other special accessories for gas operation. Air starting is standard, with 32-v electrical starting optional.
**Cummins Engine Co, Inc, Columbus, Ind.**

For more data on these items, use post cards, p167. Identify request with P and number.

### COATED FITTINGS P819

Formerly thought impossible, welding fittings and joints for corrosion-resistant coated piping are now available in all standard sizes and types of fittings and joints from ½ up to 30 in. dia. The fittings and pipings are lined with corrosion-resistant coating in the manufacturer's plants and any differences in field assembly, resulting from design layout changes, can be made in the field.

A typical fitting has three parts—an internal sleeve and two external fittings. The joint fittings are welded to the pipe end and both are then coated with a corrosion-resistant material. The sleeve is inserted into the fitting where they are butted together and seal-welded. The welding destroys the coating both inside and outside the fitting for ½ in. on each side of the weld. On the outside a cold-setting coating can easily be applied. Through a threaded opening in the fitting this cold-setting compound is fed into the interior of the fitting and the opening sealed with a tight plug.
**Welstrom, 5th St & North Ford Blvd, Hamilton, Ohio.**

### ILLUMINATION CONTROL P832

Simple, plug-in-type weatherproof illumination control, *Model 1089*, provides completely automatic on-off control of artificial lighting at predetermined light level. The unit mounts in a standard weatherproof watt-hour meter glass case and consists of a stable, dry-disk photocell, a sensitive relay operated by the photocell, a clock motor, a mercury switch, and a limit switch. It will function perfectly at temperatures as high as 140 F and down to minus 30.
**Weston Electrical Instrument Corp, 641 Frelinghuysen Ave, Newark 5, N. J.**

### FIRE EXTINGUISHER P822

Dry chemical, 4-lb fire extinguisher with a rubber hose is said to be easily operated, flexible in fighting overhead and ground-

(*Continued on page* 172)

Whether the critical pressure of your process is full vacuum, 80,000 psi, or any range between . . . the complete diversity and engineering quality of Foxboro Instruments provide a means to measure or control it with highest accuracy and reliability. Add to this an unequaled experience in applying instruments to solve processing problems, and you have the reason for Industry's preference for Foxboro Pressure Instrumentation.

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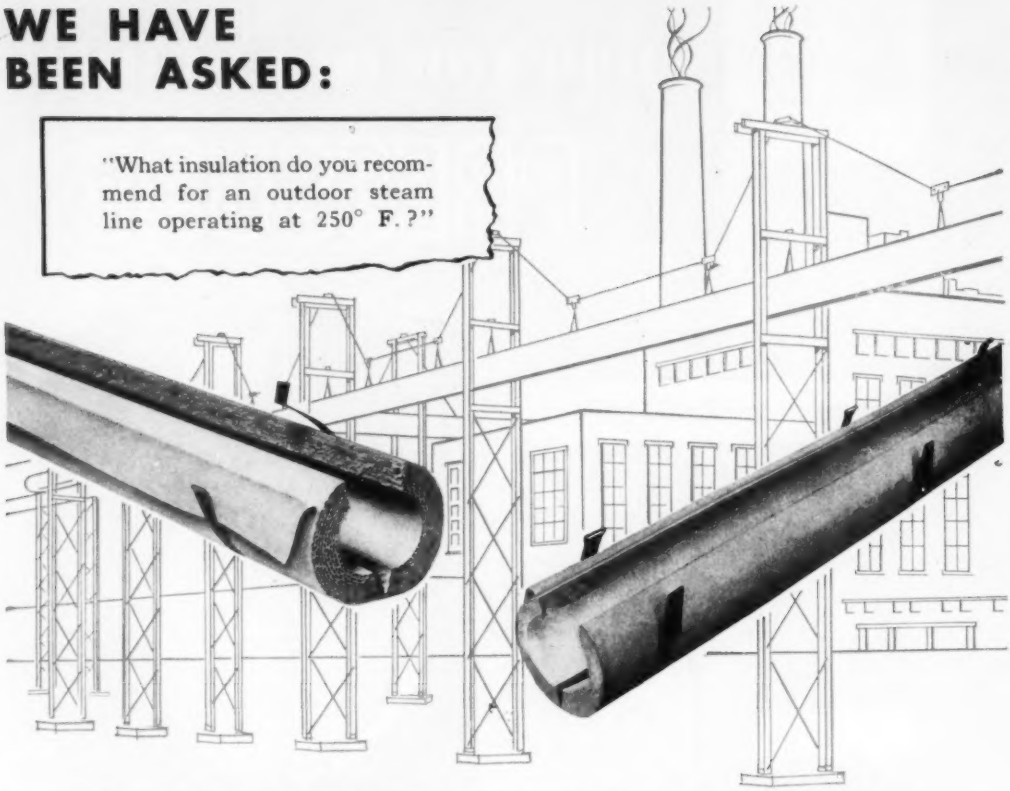
# WE HAVE BEEN ASKED:

"What insulation do you recommend for an outdoor steam line operating at 250° F.?"



"In a few months, we will have some outdoor steam lines installed in our plant," writes a power plant engineer. "Operating temperature will be 250° F.—pressure, 15 lbs. We plan to use Air Cell Pipe Covering but wanted to check this with you before we went ahead with the job. Is this the insulation that you would recommend?"

Chances are that the writer based his choice of insulation only on the fact that operating temperature would be 250° F. Air Cell is often the recommended insulation for temperatures up to 300° F. In this case, however, the outdoor location makes 85% Magnesia a much sounder investment.

85% Magnesia gives outstanding service under rugged outdoor conditions. If weatherproofing felt over the pipe covering breaks or loosens and water seeps through, the heat of the line dries out the Magnesia and restores its original efficiency. The covering does not shrink or deteriorate.

Air Cell Pipe Covering, on the other hand, is an efficient, low-cost insulation that gives good service on indoor applications where it isn't subjected to severe conditions of dampness, bumping, or abrasion.

This question points up an important part of every insulation job; double-checking your choice of insulation *before* you put it up. Trained engineers in a near-by Armstrong office will be glad to go over the specifications for any job you may be contemplating. They can also give you details on the quality materials and expert installation service offered by Armstrong's contracting organization.

**SEND US YOUR QUESTIONS:** If you have any questions on the use or application of either high- or low-temperature insulation, please do not hesitate to write to us. We'll do our best to give you a practical answer. Just address a letter or card to Armstrong Cork Co., 7008 Maple Avenue, Lancaster, Penna.

## ARMSTRONG'S INDUSTRIAL INSULATIONS

MATERIALS - INSTALLATION

FOR ALL TEMPERATURES FROM 300°F. BELOW ZERO TO 2800°F.

# *Keep Up To Date... Send In These Cards For...*

- more information about NEW PRODUCTS on preceding pages
- copies of these new . . .

## FREE CATALOGS AND BULLETINS

### AIR CONDITIONING, HEATING REFRIGERATION AND VENTILATION

**B1** **AIR DIFFUSER** — Describes the new Kno-Draft high pressure diffuser, Type HPC 11 now embodying several new developments in design. Operates at high pressure and velocities, using unusually small, exposed ducts of uniform size, space-saving. 2-page bulletin No. K-26. W B Connor Engrg Corp, 500 Fifth Ave, New York 18, N.Y.

**B2** **VENTILATORS AND LOUVERS** —Catalog covers complete line of ventilators and louvers. Design and construction features for each ventilator type plus mounting and flashing details; performance, dimension and weight data are included. Burt Mfg Co, Dept 50, 927 S High St, Akron 11, Ohio.

**B3** **AIR FILTERS**—Revised catalog of air filter sizes for air conditioning units manufactured by 31 companies. Equipment is listed under manufacturer's identification numbers to facilitate ordering of filters. 16-pages. Owens-Corning Fiberglas Corp, Dept DS1-5, Toledo 1, Ohio.

### BOILERS AND AUXILIARIES

**B4** **OIL BURNER GUIDE**—"Oil Burning Manual of Information" is a guide to proper installation and operation of oil-burning equipment. Includes among 20 selected headings such important tables as air flow through airports, available draft, excess air, boiler pressure and flue gas temperature. 4 pages. Cleveland Fuel Equipment Co, 7516 Associate Ave, Cleveland 9, Ohio.

**B5** **PACKAGED BOILER**—Describes the Tiosteam generator, a packaged steam power plant with a 3-pass forced draft taper design resulting in maximum heat absorption and fast steaming. Design features are included. 6-page bulletin No. B-3160. Titusville Iron Works Co, Titusville, Pa.

### ELECTRICAL EQUIPMENT

**B6** **STARTING SWITCH**—Data on a manual starting switch for fractional horsepower motors. Illustrated with photographs of typical installations. 8-page bulletin No. 900. Allen-Bradley Co, Milwaukee 4, Wis.

★ **BUS DUCT**—Describes types of bus duct and accessories available. Presents application and test data, specifications, and information on pric-

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# More FREE LITERATURE

ing a typical bus duct installation. 64-page manual No. B-4171A. Westinghouse Electric Co, Box 2099, Pittsburgh 30, Pa. (*Write direct to manufacturer on company stationery giving name and title.)

**B7** **TRANSFORMERS**—Technical information in the form of detailed drawings, accuracy limits, ratio and phase angle curves on current, potential and metering transformers. 11-page bulletin No. S-301-B. Standard Transformer Co, Warren, Ohio.

**B8** **FAN-COOLED MOTORS** — Describes types of construction and ratings of totally-enclosed, fan-cooled motors with tube-type, air-to-air heat exchangers. Cross-section view of horizontal motor construction features also included. 8-page bulletin No. 06B7150A. Allis-Chalmers Mfg Co, 983 S 70th St, Milwaukee, Wis.

**B9** **CARBON BRUSHES**—Illustrates and describes the fundamental considerations given to the design, application, and manufacture of carbon brushes and includes a section on brush terminology. 32-page bulletin No. GEA-5897. General Electric Co, Schenectady 5, N. Y.

**B10** **ELECTRICAL FITTINGS**—Manual contains illustrations, catalog number, price, and weight of the complete line of O Z electrical fittings. Indexed by photo, product name and catalog number. O Z Electrical Mfg Co, Inc, 363 Bond St, Brooklyn, N. Y.

**B11** **CONDUIT AND CABLE FITTINGS**—Electrical conduit and cable fittings for all types of raceways are listed. Contains many charts of connector sizes and capacities, strain relief bushings, and ground fittings. 64-page bulletin No. 65. Thomas & Betts Co, Inc, Elizabeth, N. J. (*Write direct to manufacturer on company stationery giving name and title).

## MAINTENANCE AND SAFETY EQUIPMENT

**B11** **AUTOMATIC OILER**—Broadside aids in the selection of proper visible, automatic oiler for constant level, gravity, wick, underfeed, multiple and large capacity gravity feed applications. Installation photos show actual applications. Broadside Series 4900. Trico Fuse Mfg Co, 3018 N 5th St, Milwaukee 12, Wis.

**B12** **SCREW DRIVERS** — Catalog-handbook of Vaco break-proof and shock-proof screw drivers. Also included are nut-driver kits, and other hand tools. 32-page catalog No. SD-551. Vaco Products Co, 317 E Ontario St, Chicago 11, Ill.

**B13** **STEP LADDERS**—Features all-steel mobile ladders available in models with from one to eight steps, also new 4-step Stockart ladder with adjustable push bar hangers for use with stock carts. 4-page bulletin. Ballymore Co, Wayne, Pa.

**B14** **ACID CLEANING** — Entire procedure of acid washing of boilers and other heat exchange equipment described. Contains technical data from research report on inhibitor used to protect boiler metal, and methods of control. Brochure. Sumco Engrg Inc, 144-146 Centre St, Brooklyn 31, N. Y.

**B15** **CLEANING SOLVENTS** — Describes various solvents used in power house maintenance practice, together with the procedures of their use. Booklet. Sumco Products Inc, 144-146 Centre St, Brooklyn 31, N. Y.

**B16** **INDUSTRIAL CLEANER** — Data on the Vibro pneumatic industrial cleaner applicable to many power plant and machine operations. Operates from any compressed air source and has no electric motor or rotating parts. 4-page bulletin. Patterson Products, 518 Maccabees Bldg, Detroit 2, Mich.

## MAINTENANCE MATERIALS

**B17** **FLOOR MAINTENANCE**—Graphically illustrated, pocket-sized booklet, "Over The Rough Spots" tells where to look for and how to correct bad floor conditions. How to protect concrete and wood floorings and maintain proper repair also discussed. 32 pages. Stanhard Co, 1306 Spring Garden St, Philadelphia, Pa.

**B18** **PACKINGS AND GASKETS** — Illustrates and describes 95 packings and gaskets. Furnishes construction details, service recommendations and size information on each item. Recommendation charts for wide variety of applications also given. 32-page catalog No. P-100C. Raybestos-Manhattan Inc, Packing Div, Manheim, Pa.

**B19** **PLASTIC PACKINGS**—Features "veri-pak" non-jacketed plastic packing, a dense, relatively inert packing with high compressibility that provides positive sealing at high pressures while maintaining low pressure on the packing gland. Service recommendations included. 4-page bulletin. Raybestos-Manhattan Inc, Packing Div, Manheim, Pa.

**B20** **ALUMINUM PAINT** — Lists and explains the six main advantages of Prufcoat aluminum paint, a ready-mixed, all purpose paint for use inside or outside. 1-page bulletin No. 625. Prufcoat Laboratories, Inc, 62 Main St, Cambridge, Mass.

## MATERIALS HANDLING

**B21** **CHAIN DRIVES AND CONVEYORS**—Discusses correct and incorrect ways of solving chain and conveyor installation, operation and maintenance problems. Bulletin No. 51-7. Chain Belt Co, 1600 W Bruce St, Dept PB, Milwaukee 4, Wis.

**B22** **CONVEYOR BELTS** — Handbook on spiral woven wire conveyor belts and complete conveyor systems. Illustrated are standard and special types of wire belting, weaves with specifications and detailed descriptions. 40-page catalog No. 31. Korb-Pettit Wire Fabrics & Iron Works Inc, 1505-15 N Mascher St, Philadelphia 22, Pa.

**B23** **COAL HANDLING**—Gives forty-two illustrations of Cummins diesels at work in U. S. coal fields in various applications such as stripping and loading, hauling, stationary power and transporting. 8-page bulletin No. 5817. Cummins Engine Co, Inc, Columbus, Ind.

**B24** **TROLLEY HOISTS**—Gives specifications of ¼- to 2-ton trolley hoists along with dimensions and construction details. 2-page leaflet No. DH360. Wright Hoist Div, American Chain & Cable Co, York, Pa.

**B25** **OSCILLATING CONVEYORS** — Describes construction and operation of oscillating trough conveyors and gives their capacity and horsepower charts and layout arrangements. 4-page folder No. 2378. Link-Belt Co, 307 N Michigan Ave, Chicago 1, Ill.

## MECHANICAL TRANSMISSION

**B26** **SPEED CHANGER** — Type 4B miniature variable-ratio speed changer with lever adjustment described. Advantageous in applications

(Continued on page 184)

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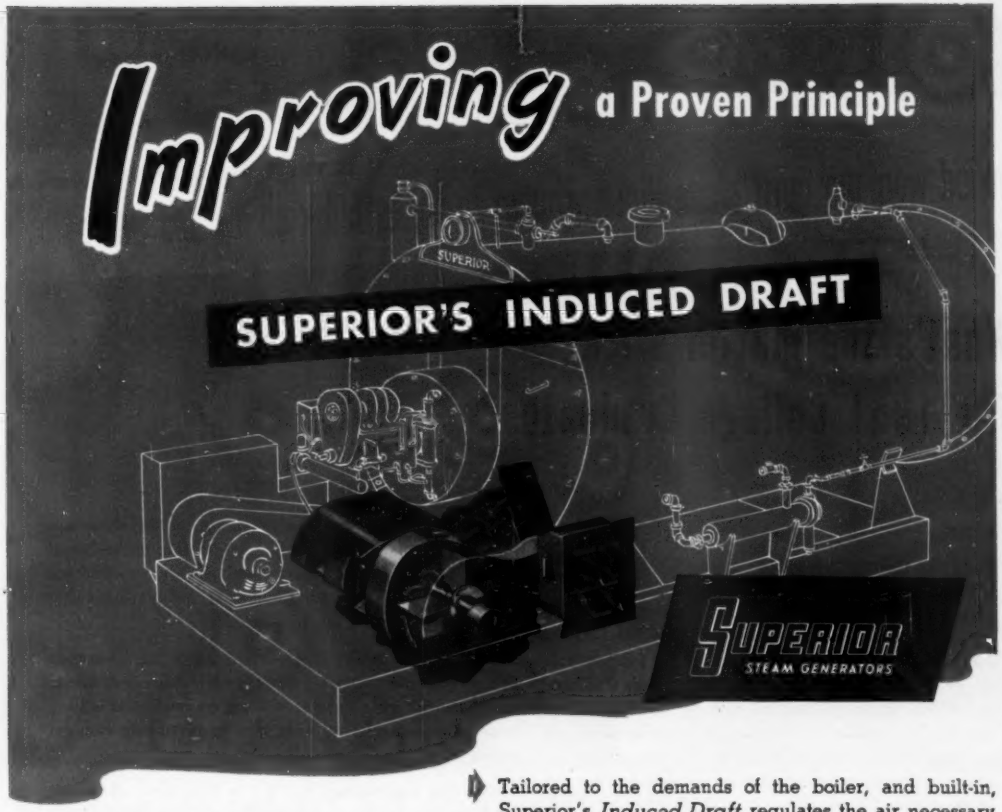
# Improving a Proven Principle




Built to operate on the same proven principle as natural draft, Superior's *Induced Draft*, because of its built-in design, low-speed fans, and unique construction, assures maximum boiler capacity at high efficiency. It provides accurate control of draft conditions without the usual disadvantages of mechanical draft. Cleaner, quieter, and safer in every respect, it represents but one of the many "Designed by Demand" features which contribute to the overall efficiency and long life of Superior Steam Generators.

Superior Steam Generators are shipped completely assembled, backed by undivided responsibility • Burn gas or oil, or both • 18 sizes from 20 to 600 b.h.p. for pressures up to 250 p.s.i. or for hot water • Write today for Catalog 301.

1. Tailored to the demands of the boiler, and built-in, Superior's *Induced Draft* regulates the air necessary for efficient combustion. Leaves front platform clear.
2. Full-width fan construction minimizes the danger of overworked or burnt-out tubes by providing an even draw across the entire tube area of the boiler.
3. *Induced Draft* eliminates the danger of forcing the products of combustion into the boiler room to spread dust, dirt, and unhealthful air throughout the building.
4. Especially-designed over-size fans run slower, minimizing wear and maintenance.
5. Quieter, low-speed fans eliminate the high-pitched whine commonly associated with forced mechanical draft.
6. Long-lived trouble-free operation assured by corrosion-resistant fans with outboard mounted bearings located out of the path of combustion gases.
7. Eliminates the expense of a large chimney.

Superior Combustion Industries, inc.

*Factory:* Emmaus, Pa.
*Executive Offices:* Times Tower, Times Square, New York 18, N. Y.

# What's the Matter With The 1951 College Graduates?

. . . That's what a fellow engineer asked me in this letter:

"Can you tell me what is the matter with the graduates that colleges are now turning out? We have one in our plant; he has a wonderful education and can out-figure me most any day in the week as I have been out of college since 1918. But he wants to start at top pay with the word *work* cut out. I've talked with friends who have hired 1951 graduates and the story is the same. These men have a wonderful opportunity to get valuable experience, but they seem to know it all. I just cannot see who is going to carry on after we old fellows pass out of the picture."

Many of us have faced that same problem at one time or another—kids who think they know it all and want to start at the top without getting their hands dirty. But given a little time with a few hard knocks, most of them will straighten out and use their education to become topnotch engineers. With a little patience and understanding on our part, plus the proper amount of discipline, they shouldn't be too hard to handle.

But there is one fatal mistake a recent graduate can make that will cause trouble for all concerned: *that's to look down on the men in overalls.*

Once a young fellow actually lands a job, his sheepskin doesn't mean much. It may be years before his technical education can really be put to work. He's got to find out that there's a lot to learn about men and machines that was never written in the textbooks.

Much of this practical education will come from men he may consider pretty far down the line—firemen, oilers, maintenance men, etc. Most of them are ready and willing to teach a young fellow what they know to help him get ahead.

But first impressions last for a long time. A recent graduate that comes swaggering in and tries to show off *his* knowledge will be a long time getting the help he needs to get ahead. As they say in the Navy: It's the "chiefs" who turn midshipmen into admirals.

I know, because there isn't a job in our plant that some man under me can't do better. And believe me, even today, without their advice I wouldn't be able to run the plant.

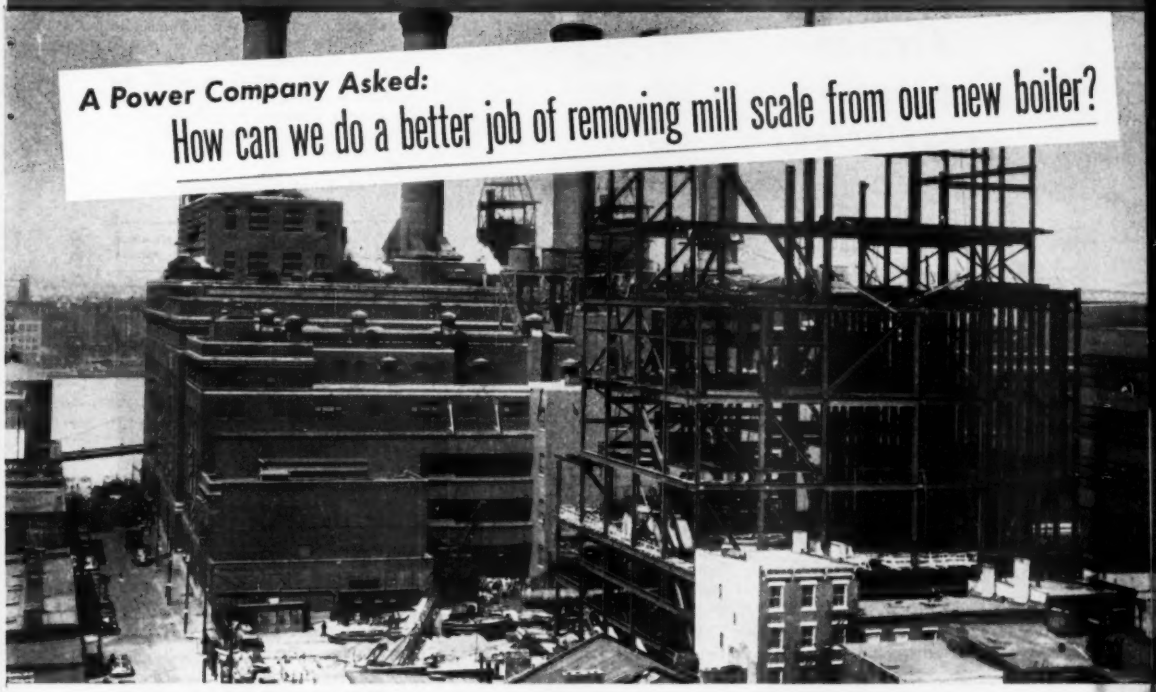
If we can get that idea across to any recent graduates we hire, they'll have an easier time breaking in and we in turn will get the benefit of their education that much sooner.

George Edwards

*Engineer*

# DOWELL SERVICE

CHEMISTRY APPLIED TO MAINTENANCE CLEANING PROBLEMS



**A Power Company Asked:**

## How can we do a better job of removing mill scale from our new boiler?

## Dowell Service removed mill scale AFTER ERECTION... leaving the internal surfaces clean for best operation!

A large power company installed a new 1,370,000 lb. per hour boiler. Specifications called for Dowell Service to remove the mill scale from the boiler *after erection*. This company found the Dowell way of removing mill scale to be good insurance for satisfactory boiler operation.

Dowell engineers filled the new boiler with specially selected liquid solvents designed to dissolve out mill scale. Unless it is removed, mill scale may retard heat transfer, slough off particles which abrade the system during operation, and act as a base for further corrosion. Dowell furnished trained personnel and special equipment to do the entire job in a few hours. Removal of mill scale *after* equipment erection can eliminate much of the extra care required in the handling of previously sand blasted or pickled tubes. It may also substitute for the grease-removing alkaline pre-boil.

Maintenance engineers in industrial plants throughout the country have found Dowell Service can provide *fast, effective and economical* cleaning of boilers, condensers, heat exchangers, water lines and other operating equipment. Experienced engineers will consult with you on your particular problems. Call Dowell today.

### *Other recent Dowell jobs:*

Three Dowtherm boilers in a southwestern chemical plant were cleaned by Dowell Service. Carbonaceous type deposits were removed.

•

Two bubble cap columns in an oil refinery were clogged with a complex deposit of antimony and aluminum salts. After Dowell Service, the towers were found to be spotless.

•

Rotor and stator of a 625 K.W. turbo-generator were fouled with a carbonate deposit carried over from the boiler. Dowell Service cleaned blading completely in 3 hours. Result: Machine is running smoothly again.

## DOWELL INCORPORATED • TULSA 3, OKLAHOMA

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★ *Maintenance cleaning service for industrial heat exchange equipment.*
★ *Chemical services for oil, gas and water wells.*
★ *Magnesium anodes for corrosion control.*

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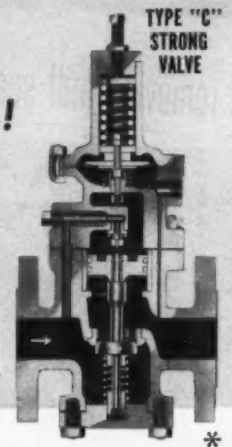
# GET THIS VALVE!

***Accurate pressure regulation!***

**FOR HEATING OR PROCESS JOBS:**

- ...with intermittent or fluctuating demand;
- ...requiring accurate control;
- ...where dependability is essential.




## For positive control, use this STRONG* single-seated, pilot-controlled valve!

Simple design, extra-heavy construction make STRONG's Type "C" regulating valve give trouble-free regulation. Semi-steel for pressures to 250 psi, 450° F.; cast steel to 600 psi, 750° F. With Anum-Metl† seat and disc, this valve automatically adjusts itself to control the flow of steam, air or gas required to maintain reduced pressure.

Write us about your pressure reducing problem or request our complete steam specialties Catalog 68-P.

**TYPE "O"**

Direct operated. Semi-steel construction suitable for initial pressures to 225 psi, 400° F. For steam, air, water or gas.

Features internal strainer, Anum-Metl† seat and disc. Direct operated, of extra heavy semi-steel, this valve is suitable for pressures to 225 psi, 400° F.

**TYPE "K"**

*Trade Mark Reg. U. S. Pat. Off.

**STRONG, CARLISLE & HAMMOND COMPANY**

1392 WEST 3rd Street
Cleveland 13, Ohio

†Anum-Metl Reg. Trade Mark

OTHER STRONG STEAM SPECIALTIES

No. 070 Small Trap | "SY" Strainer | 800 Series Steel Trap

**STRONG**


# More EQUIPMENT NEWS

Begins on page 158

level fires, and to have a maximum extinguishing effectiveness for inexperienced operators. Its range is 12 to 15 ft. Dry chemical is ejected from the 4-lb extinguisher through a self-closing nozzle that produces a fan-shaped stream pattern under pressure developed by a 1½-oz carbon-dioxide cylinder in the dry chemical chamber. Each unit is subject to 600-psi hydrostatic test.

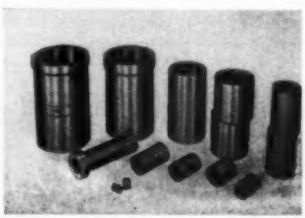
**Ansul Chemical Co, Marinette, Wis.**

For more data on these items, use post cards, p167. Identify request with P and number.

**CONTROL VALVE** **P836**

This valve is designed for controlling flow of bulk materials from bins, hoppers and chutes in weighing, blending and packaging operations. It can also be used for free air control in heating, ventilating and drying. Flexible diaphragm made of cotton, duck, nylon, rubber or other materials, operates like the iris diaphragm of a camera. Control lever changes diaphragm opening size, material flow. Material passing through valve does not contact any moving metal parts so there is no possibility of jamming or clogging of materials. Valves are easily attached to bin and hopper discharge openings, supply chutes and ducts or in air ducts. Fabric diaphragm withstands many months of hard use and is replaceable at low cost. Available in 5 different sizes to fit openings up to 12 in. dia.

**Syntron Co, 492 Lexington, Homer City, Pa.**



**BRONZE BEARINGS** **P820**

Plain, flanged, split, or any combination bronze bearings and bushings from small sizes up to those 24 in. dia can be had

# ARE YOU ON A MAINTENANCE MERRY-GO-ROUND?

Every year, the United States spends the fantastic sum of *over eight billion dollars* just on maintenance of its industrial plant—sad proof that too many companies are on a "maintenance merry-go-round"!

Needless to say, this huge expenditure cuts deeply into profits . . . makes it imperative for you to examine *your* maintenance costs—find ways to keep them as low as possible.

One proved way to do this is to see that all your machines get *Correct Lubrication*. This means far more than just "oils and greases." It means an analysis of your plant, recommendations of the right lubricants, guidance on when and how to use them.

Socony-Vacuum, with 85 years of experience, provides this combination of knowledge and product in one completely integrated lubrication program, tailored for your individual plant.

Why not start such a program now . . . and start cutting *your* maintenance costs?

SOCONY-VACUUM

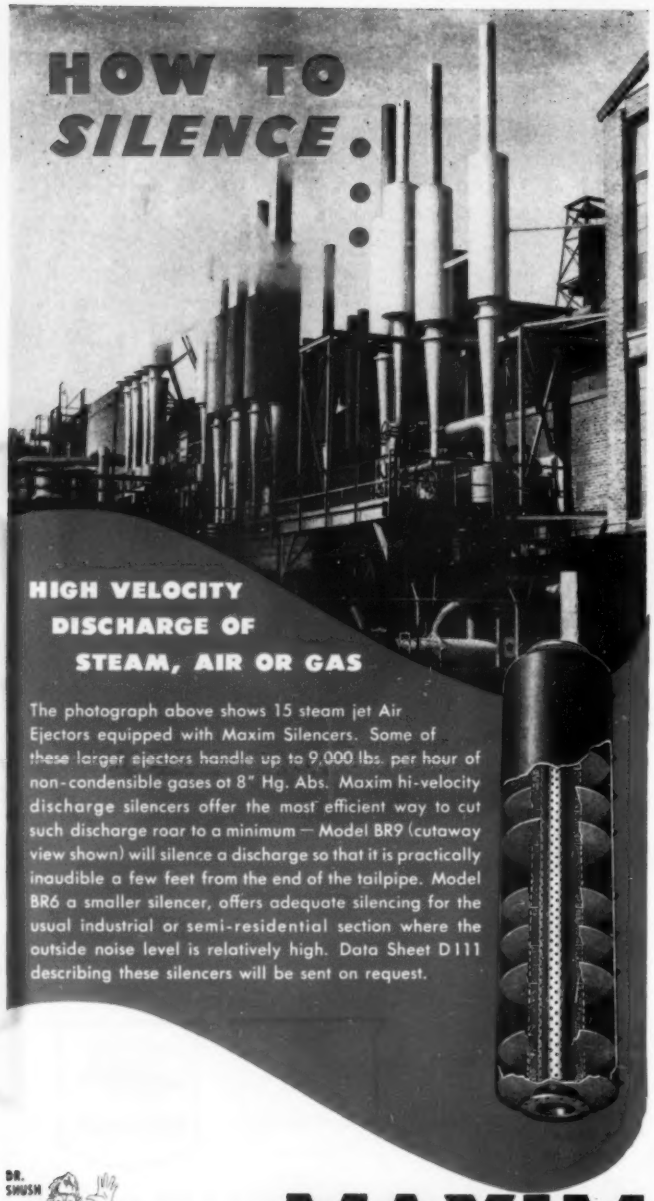
GARGOYLE Lubricants

## SOCONY-VACUUM

*Correct Lubrication*

WORLD'S GREATEST LUBRICATION KNOWLEDGE AND ENGINEERING SERVICE

SOCONY-VACUUM OIL COMPANY, INC., and Affiliates:
MAGNOLIA PETROLEUM COMPANY, GENERAL PETROLEUM CORPORATION




**HIGH VELOCITY DISCHARGE OF STEAM, AIR OR GAS**

The photograph above shows 15 steam jet Air Ejectors equipped with Maxim Silencers. Some of these larger ejectors handle up to 9,000 lbs. per hour of non-condensible gases at 8" Hg. Abs. Maxim hi-velocity discharge silencers offer the most efficient way to cut such discharge roar to a minimum — Model BR9 (cutaway view shown) will silence a discharge so that it is practically inaudible a few feet from the end of the tailpipe. Model BR6 a smaller silencer, offers adequate silencing for the usual industrial or semi-residential section where the outside noise level is relatively high. Data Sheet D111 describing these silencers will be sent on request.

*Consult* **MAXIM**

**THE MAXIM SILENCER COMPANY 92 HOMESTEAD AVE., HARTFORD 1, CONNECTICUT**

Gentlemen: Please send for bulletin on High Velocity Discharge Silencer

NAME _____

COMPANY _____

ADDRESS _____

RMYR1

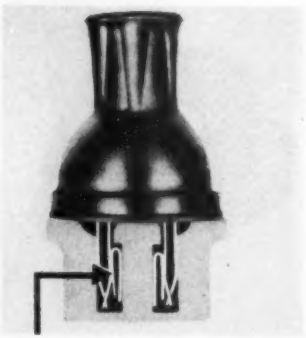

# More EQUIPMENT NEWS

*Begins on page 158*

with finishes ranging from an accurate machined one for precision applications to a semi-finish for rough work. The bearings are cast from rigidly controlled metals of the proper type for the particular use and can incorporate special lubrication designs to meet individual requirements.

**Bronze Bearings, Inc, 964 North Ave E, Cranford, N. J.**

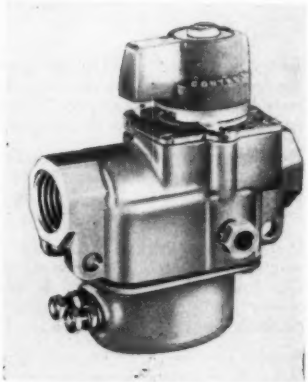
For more data on these items, use post cards, p167. Identify request with P and number.



**ELECTRICAL PLUG** **P807**

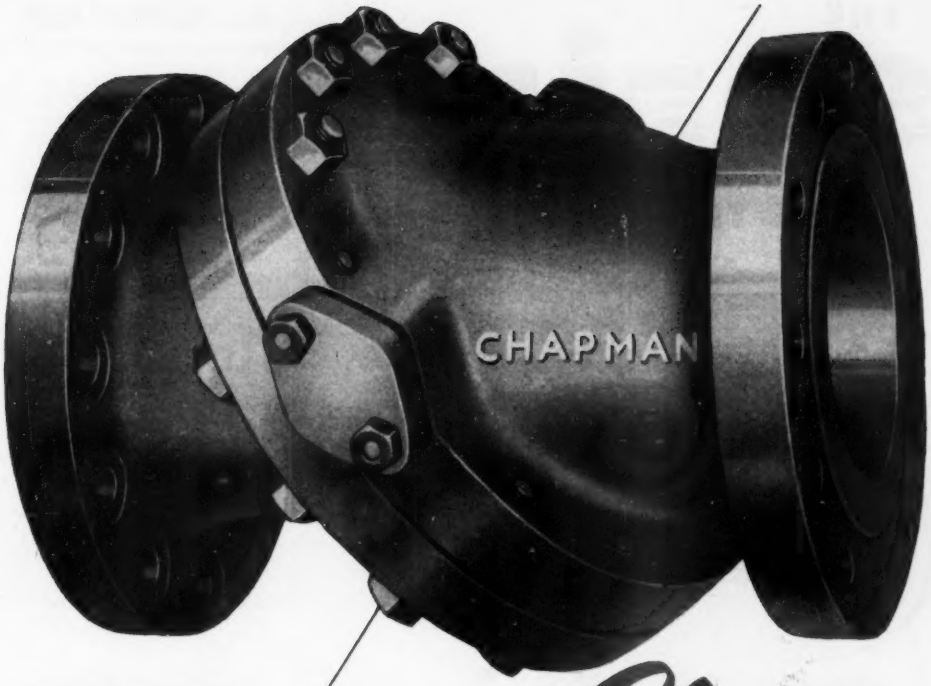
Double-spring type blades of the new *Waldron* plug bow out in both directions to insure positive connection, regardless of where contact is located in the electrical outlet receptacle. The blades possess a flexibility that prevents the plug dropping from loose receptacles, yet it does not pull out too hard in a tight receptacle. These blades have been approved by Underwriters Laboratories for use on electrical cords in making connection up to 15 amp of current at 120 v, or 10 amp at 220 v.

**Laminated Metals Products Corp, 9993 Broadstreet, Detroit 4, Mich.**

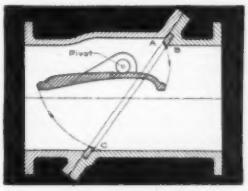


**GAS SAFETY VALVE** **P823**

Combination safety and plug valve, MR-5, has a particular advantage in that it fails to the safe side in a pilot-flame failure.




# YOU GET *Cushioned Closing* WITH CHAPMAN TILTING DISC CHECK VALVES




Cross-section of the Chapman Tilting Disc Check Valve illustrating the way that the balanced disc is supported on the pivot, with arrows showing the travel of the disc. A feature of the design is that the disc seat lifts away from the body seat when opening, and drops into contact when closing, with no sliding or wearing of the seats.

There's no impact on closing — with this valve by Chapman. The balanced disc rides the flow smoothly — uses the fluid or gas itself to cushion the closing action. The disc lifts away from the seat easily on opening; closes quickly, positively—yet quietly.

Consequently, there's no rubbing on the seats—little wear on hinge pins and bearings. Repair needs are at a minimum — maintenance costs low.

Chapman Tilting Disc Check Valves are available in either iron or steel. Write today for catalog with complete technical information.

**The Chapman Valve Manufacturing Company**
INDIAN ORCHARD, MASSACHUSETTS

THE
spring
IS THE THING

AJAX
SPIRAL WOUND GASKETS

KNIFE-EDGES *BITE* INTO FLANGE SURFACES

*PRESSURE-SEALED*

THEY *BREATHE* WITH VARYING PRESSURES AND TEMPERATURES

*LIGHTER* BOLT LOADS. *SAFER* SEALS

NO DRIP—NO SQUIRT—NO HISS

The Gaskets with resilience "built in," to make positive, lasting seals. Made for all types of pipe flanges, pressure vessels, and for boiler manholes, handholes, tube caps, water walls, economizers and other boiler accessories. A trial will end your gasket troubles.

OTHER STANDARD INDUSTRIAL GASKETS

In addition, we offer a complete line of corrugated metal and metal-asbestos gaskets; solid metal, serrated and profile types. Sold universally through Industrial Distributors. Ask your Supply House or write

UNITED STATES GASKET COMPANY

680 N. 10th Street Camden 1, N. J.

*Leading Fabricators of "TEFLON" for the Chemical, Process and Electronic Industries.*

# More EQUIPMENT NEWS

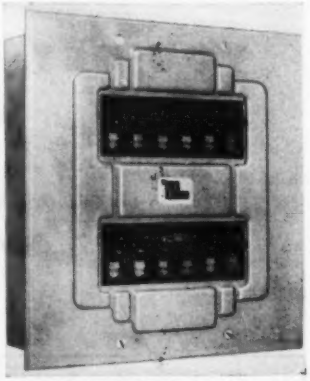
Begins on page 158

MR-5 is principally a safety shutoff valve consisting of a thermocouple incorporated in a high-flow gas cock valve structure. Through its use and its lighting cycle, it is impossible to allow gas flow into the main burner when it is operating.
**General Controls Co, 1801 Allen Ave, Glendale, Calif.**

For more data on these items, use post cards, p167. Identify request with P and number.

**POWER SUPPLY** **P830**

A regulated high-voltage power supply with low ripple content and low output impedance is possible with the *Model 1250* power supply. The high-voltage supply is continuously variable from 200 to 1000 v, and delivers from 0 to 500 ma. Power supply includes input and output fuses on the front panel, a time delay relay, and an overload relay. The high-voltage dc terminals are clearly marked on the front panel. The negative side of the high voltage is grounded to the chassis. The rack panel cabinet measures 28 in. high, 21½ wide, and 16 deep. Total weight is about 167 lb.
**Kepco Laboratories, Inc, 149-14 - 41st Ave, Flushing, N. Y.**

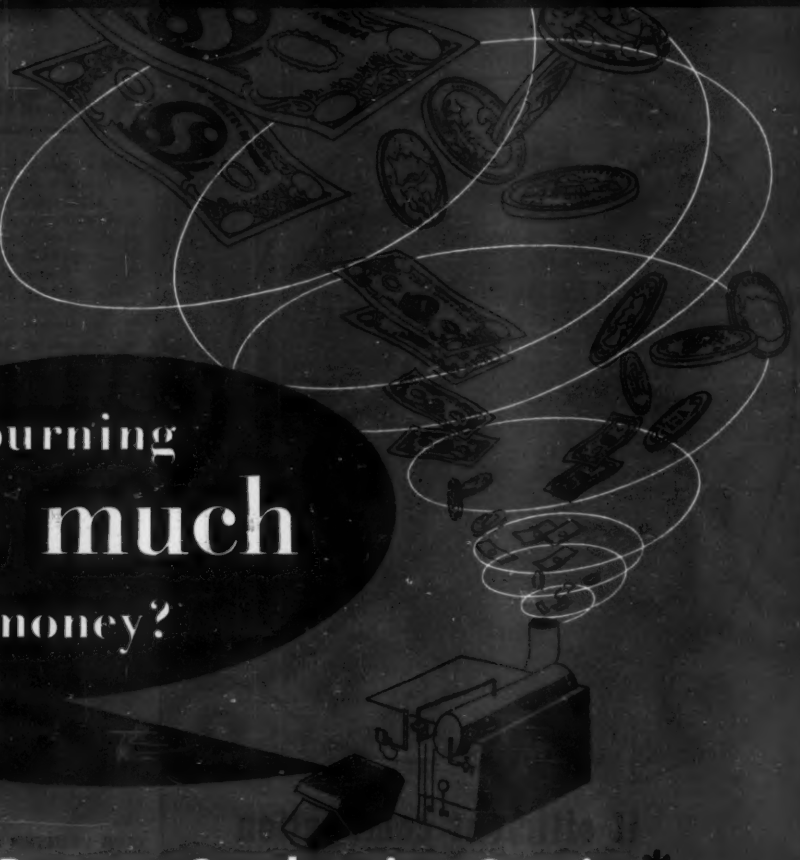


**CIRCUIT BREAKER** **P804**

Manufacturer's new circuit breaker has 12-circuit capacity, equips each breaker with magnetic action. This 12-circuit unit consists of four 15-amp breakers, plus two 20-amp ones with provision for six additional. Six pairs of handle extensions are supplied. No main switch is required ahead of the unit.
**Murray Mfg Co, 1250 Atlantic Ave, Brooklyn 16, N. Y.**

**PEN RECORDER** **P818**

Electronic, high-speed pen recorder measures rapidly changing variables, such as those developed in laboratories and test applications. Device will prove helpful in analyzing fuel efficiencies and engine design, for spectrographic and other analyses where high scanning rates and narrow change increments are encountered. Full-



# burning too much money?

## perhaps Beacon Combustion Service*

### can help you cut B. T. U. costs

* A service, by our technically trained representatives, designed to help you get MORE from your fuel. Available at no cost or obligation in areas covered by Beacon Coal Sales Offices.

If you're looking for ways to cut your fuel bill . . . (and who isn't) you may find it profitable to talk to a Beacon Combustion Service Man. In a number of plants, minor changes in firing procedure, addition of inexpensive auxiliary equipment, or a change in fuels has brought remarkable and gratifying results.

FOR EXAMPLE: Firemen reported "everything fine" in a big heating plant . . . but a Beacon Combustion Service flue gas check showed only 6% $CO_2$ instead of 13-14%. Further inspection revealed air "by-passing" fire at rear. Balancing stoker stroke and feed filled blowholes, brought $CO_2$ to the proper point, with an increase of 20% or better in boiler efficiency.

FOR EXAMPLE: Boiler serving widely varying load used too much fuel in stand-by periods. B.C.S. Man suggested motorized draft control. Results: substantial part of the coal once wastefully burned in off-periods was saved.

FOR EXAMPLE: Long-flame fuel in short-fire-travel boiler was wasting much of heat up stack. B.C.S. Man recommended change to low-volatile fuel. Fuel cost per *ton* was higher—but cost *per utilized* B.T.U. actually dropped.

Perhaps your plant efficiency, too, can be upped by a change in firing practice, by addition of inexpensive auxiliary equipment, or by change in the type of coal. The B.C.S. Man will be glad to confer with you in working out the most profitable procedure for your plant.

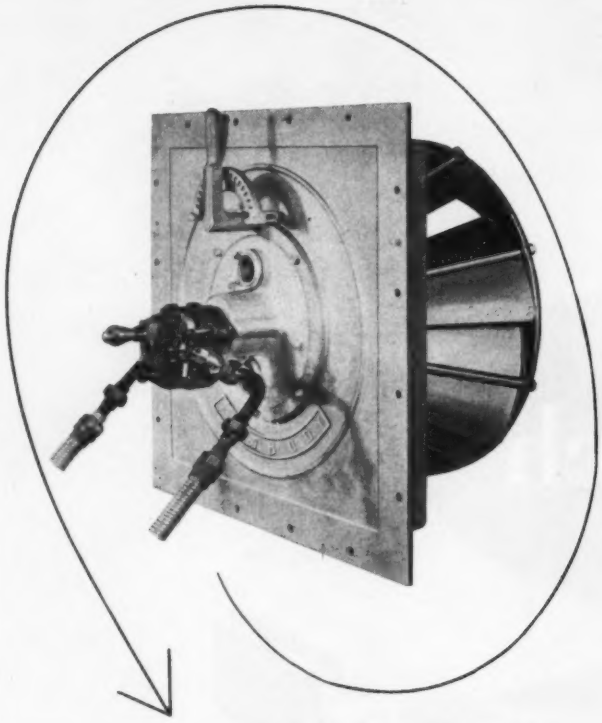
*NOTE TO COAL DEALERS: If any of your commercial or industrial customers or prospects have a problem like this, your B.C.S. Man will be glad*

EASTERN GAS AND FUEL ASSOCIATES — BEACON COAL

## EASTERN GAS AND FUEL ASSOCIATES

PITTSBURGH BOSTON CHICAGO CLEVELAND DETROIT NEW YORK
NORFOLK PHILADELPHIA SYRACUSE

*For New England:* New England Coal & Coke Co., *For Export:* Castner, Curran & Bullitt, Inc.



if efficient combustion is important...

look to PEABODY

The same principles of design that have made Peabody Oil and Gas Burners the standard of excellence the world over are also available in Peabody Combined Burners for gas, oil, pulverized coal, and other types of fuels.

If you have a combustion problem that requires a custom-engineered solution and maximum efficiency, call your nearest Peabody representative or write us direct. No obligation.

PEABODY
ENGINEERING CORPORATION
580 FIFTH AVENUE • NEW YORK 19, N. Y.
Manufacturers of all types of combustion equipment, direct-fired air heaters, gas scrubbers, coolers, and absorbers

OFFICES IN PRINCIPAL CITIES 772

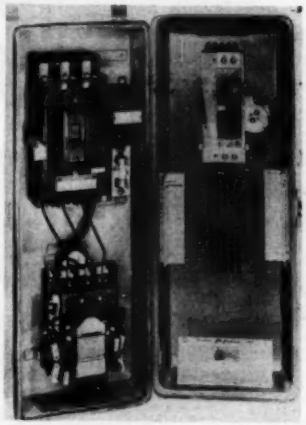
PEABODY LIMITED • LONDON, S.W.1, ENGLAND

# More EQUIPMENT NEWS

Begins on page 158

scale signals, which vary as rapidly as 20 cycles a minute, can be recorded on this new model; also, those with peak-to-peak amplitude of 10% of scale, varying as rapidly as three cycles per second.
**Minneapolis-Honeywell Regulator Co, Brown Instrument Div, Wayne & Windrim Aves, Philadelphia, Pa.**

For more data on these items, use post cards, p167. Identify request with P and number.



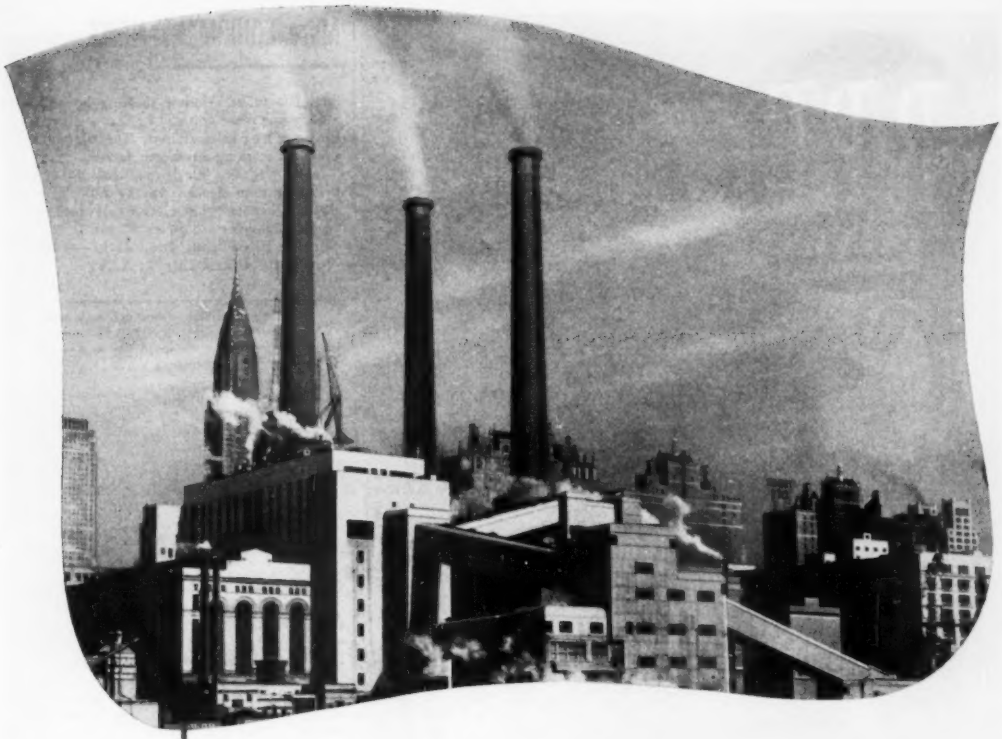
**LINE STARTER** **P801**

Improved starting and control of machine tools can be had with the new combination *Life-Linestarter* (Class 11-206-NJ). The starter enclosure, NEMA type 12, has a continuous neoprene gasket and mounts on external brackets. There are no knockouts or mounting holes in the box itself.

Breaker operates by a slam-proof self-indicating external handle, but the enclosure must be opened to reset the overload relay. In this way the overload is brought to the operator's attention. The starters are furnished as standard with a 220-440-v primary, 110-v fused secondary, and a control circuit transformer that can be used on either 220- or 440-v supply voltage, 50 or 60 cycles.
**Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.**

**TUBE CLEANER** **P814**

Fastest, most economical straight-tube cleaner developed by the manufacturer, called *Model TP-301*, is lighter in weight than previous products, weighing only 15 lb; is shorter, 13 in. over-all; yet has increased cleaning capacity. It comes in sizes to handle from ⅜ up to 2½ or even



**Whatever equipment you prefer, here's the secret of**

# LOW-COST POWER

When choosing your fuel, always keep these three factors in mind:

1. ***The types available.*** Along the Baltimore & Ohio, you're sure to find the type that exactly meets your needs. The modern mines in this area produce a wide variety of excellent Bituminous.
2. ***Nearness to your plant.*** With its 11,000 miles of track, the B&O offers efficient economic transportation to plants throughout the heart of industrial America.
3. ***Reserves on hand.*** Virtually limitless reserves of power-packed Bituminous lie in the vast B&O territory—a supply that will last for centuries.

For the secret of dependable, low-cost power as related to your specific needs, *ask our man!*

**Bituminous Coals for Every Purpose**

LINKING 13 GREAT STATES WITH THE NATION — B&O

## BALTIMORE & OHIO RAILROAD

**Constantly *doing things*—better!**

R·P&C
VALVES

NO. 6056
Forged
Steel
Gate Valve

**Here is a Premium Valve that is NOT premium priced**

*CHECK THESE DESIRABLE FEATURES:*

- Bolted bonnet construction
- Heat-treated and hard chrome plated stainless steel wedge
- Stainless steel gland eye-bolts and nuts
- Two-piece gland and follower
- Tongue and groove bonnet joint

*It's well designed. It's low priced in its field.*
*See your R-P & C distributor or write nearest R-P & C district office.*

ACCO
Reading, Pa., Atlanta, Baltimore, Boston, Chicago, Denver, Detroit, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

R-P & C VALVE DIVISION
AMERICAN CHAIN & CABLE

"Intentionally Better"
READING-PRATT & CADY VALVES

# More EQUIPMENT NEWS

Begins on page 158

3-in. OD tubes. Hollow shafting is available in one piece up to 20 ft, or in sectional threaded lengths if desired. The minimum practical working headroom is 5 ft.

This positive, air-driven, rotary-shaft, drill-type tube cleaner scavenges the tube with air or water while cleaning. It operates on air pressures as low as 50 psi.

**Thomas C Wilson, Inc, 21-11—44th Ave, Long Island City 1, N. Y.**

For more data on these items, use post cards, p167. Identify request with P and number.

**HYDRAULIC PULLER P834**

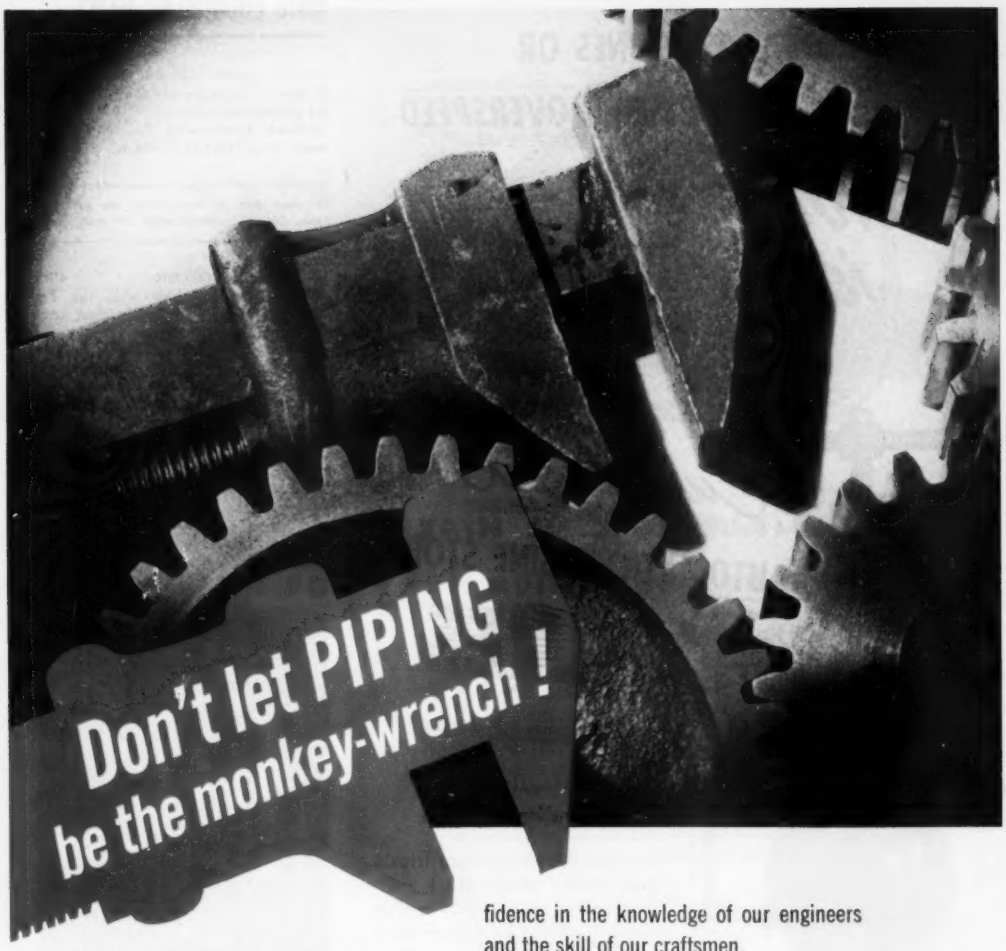
Versatile, effective, *Power-Twin* hydraulic puller has a capacity of 17½ tons and weighs only 10 lb. It features the center-hole design of the manufacturer so it can be adapted to all pulling systems now supplied by this concern. Full details are available in the bulletin, *Power-Twin Hydraulic Puller.*

**Owatonna Tool Co, 378 North Cedar St, Owatonna, Minn.**

**DISPLACEMENT INDICATOR P825**

Electronic displacement indicator and controller, *Type 131,* for use with the *Schaevitz* linear variable differential transformers and pressure transmitters, has a range of displacement control from plus or minus 0.001 in. to 1.0 and displacements greater than this range may be handled through mechanical leverage. Pressure control is available in the range from 0 to 10,000 psi.

Manufacturer states that this device may be used as a controller for leveling operations, a remote indicator and controller for scales, a torque indicator and controller, a




**Our piping service is geared** to help you finish that vital new power plant in record time. And we can offer you more than just speed. Our high-temperature, high-pressure installations have established a solid reputation for quality during the past half century. Today, most of the nation's leading utilities and process plants have confidence in the knowledge of our engineers and the skill of our craftsmen.

Let us give you an estimate on your next job—you'll save time and money.

We are independent piping fabricators and erectors.

**W. K. MITCHELL & CO., INC.**

**2944 Ellsworth Street, PHILADELPHIA 46, PA.**

*Representatives in Boston, New York, Cleveland, Mobile and Havana*

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**MITCHELL**

PIPING FABRICATORS AND CONTRACTORS SINCE 1899

WHEN ENGINES, TURBINES OR

COMPRESSORS *OVERSPEED*

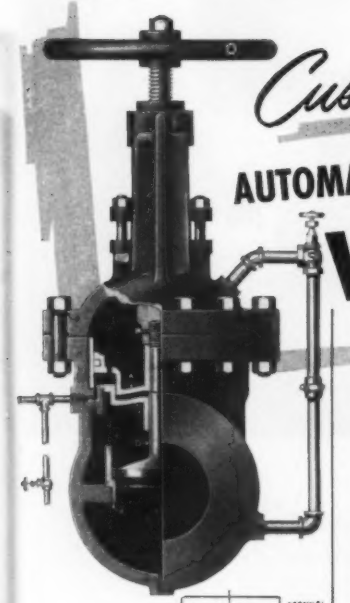
*Shutdown is Automatic*

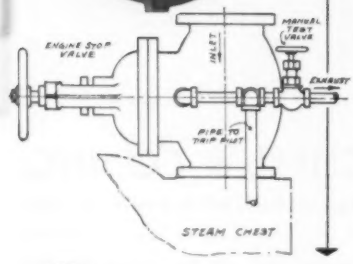
with GA

*Cushioned*

AUTOMATIC ENGINE STOP

VALVES






**Mechanically or Electrically Tripped**

A single speed governor trips a pilot control valve, which automatically closes this valve against inflow pressure—thus assuring complete protection from damage caused by overspeeding.

All Golden-Anderson Valves have a special double cushioning feature which prevents banging and chatter.

Get the life and property protection you need—specify and install Golden-Anderson cushioned engine stop valves today!

Do you have Bulletin S-3 which describes this valve in detail?

GOLDEN ANDERSON *Valve Specialty Company*

2070 KEENAN BUILDING • PITTSBURGH 22, PA.


# More EQUIPMENT NEWS

Begins on page 158

tension controller, and a position controller, as well as an automatic control or shutoff for pressure systems.

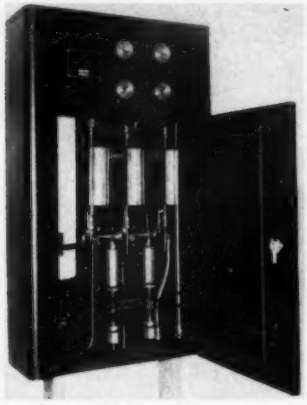
**Sterling Instrument Co, 13331 Linwood Ave, Detroit 6, Mich.**

For more data on these items, use post cards, p167. Identify request with P and number.

**PACKAGED BOILER** **P831**

Completely assembled unit, the *Titosteam* packaged boiler, is finished, tested and certified at the factory. Its operation is fully automatic with all controls contained in a single pushbutton-controlled station. The generator mounts on a steel skid and can be installed on level and solid floors without foundation construction. When service connections are made to fuel, water, steam and electrical supplies, the boiler is ready for operation. No stack is needed; a vent through the roof is sufficient. Thermal efficiency runs not less than 80% for oil and 75% for gas firing.

**Titusville Iron Works Co, Div of Struthers-Wells Corp, Titusville, Pa.**



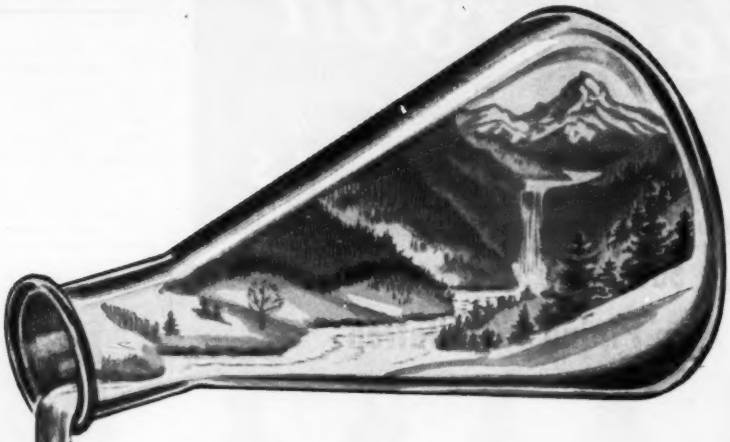
**AUTOMATIC DEGASSER** **P811**

Designed primarily for determining steam purity, the *Hagan* automatic degasser produces continuously and automatically an approximately 50-50 split of a flowing steam sample. One fraction contains any dissolved solids that may be present and the other any dissolved gases. This latest model is distinguished by a new case of mild steel finished in black and specially treated to minimize corrosion. The new design makes it easy to disassemble the unit, and increases the accessibility of its inner workings.

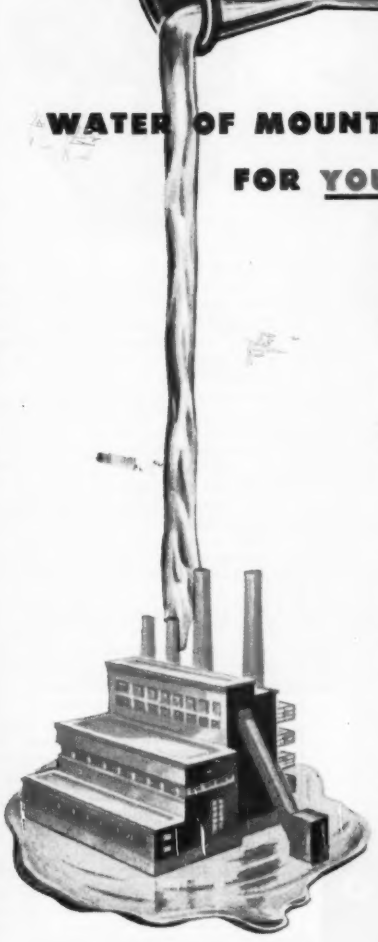
**Hagan Corp, Hagan Bldg, Pittsburgh 22, Pa.**

**WATER REPELLENT** **P833**

Silicone base, liquid, water-repellent for uncoated exterior masonry walls, *Monoseal*, is said to penetrate from ¼ to ⅝ in. into masonry surfaces and provides superior water repellency for years. This thin, trans-



# WATER OF MOUNTAIN STREAM QUALITY FOR YOUR BOILERS—AT YOUR DOOR



Melting snow, near the source of a mountain stream, gives unusually pure natural water. Nice if your power plant is nearby. But if it isn't . . .

You can still feed your boiler highest quality water, by treating it with AMBERLITE deionizing resins. For an AMBERLITE Ion Exchange unit can reduce total ionized solids virtually to zero. That means zero silica, zero carbon dioxide, zero hardness—all at low cost. AMBERLITE units are trouble-free, too. And they give you an assured supply of the water you need, despite wide variations in the *quantity* demanded and *quality* of the raw water supply.

Tired of fuel-consuming evaporation or low capacity, unstable exchangers? Then discuss AMBERLITE deionization with your consulting engineer or water-conditioning-equipment manufacturer. He'll be glad to show you how to adapt the various combinations of AMBERLITE resins to your specific water conditions.

*Newest Word in Water-Treating*

**MONOBED DEIONIZATION**

One pass through one column of AMBERLITE mixed anion and cation exchange resins can transform raw water into deionized, silica-free water. Ask for our 12-page booklet, "Monobed Deionization."

CHEMICALS FOR INDUSTRY

**ROHM & HAAS COMPANY**

**THE RESINOUS PRODUCTS DIVISION**

Washington Square, Philadelphia 5, Pa.

*Representatives in principal foreign countries*

AMBERLITE *is a trade-mark, Reg. U. S. Pat. Off. and in principal foreign countries.*

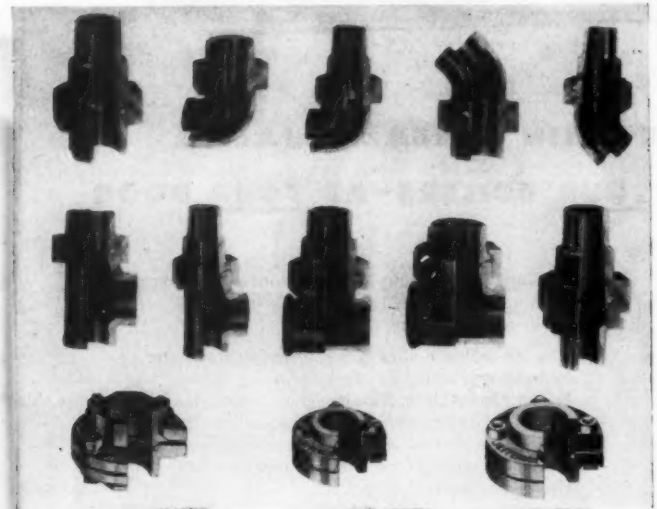
# Jefferson

AIR-REFINED, AIR-TESTED
MALLEABLE IRON

**UNIONS**

... featuring the RECESSED BRASS SEAT

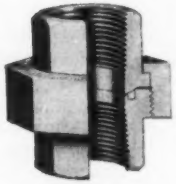
## Save Time and Expense in Piping Installation



The fact that Jefferson Unions are made in all types—straight through, union ells, union tees and flange unions—means that pipe jobs can be simplified, pipe joints saved, and better jobs assured at lower cost.

Exclusive with all Jefferson Unions is the brass seating ring made from seamless tubing (not cast) and pressed into a *machined* recess. In addition to the full protection and free flow provided, there is no possibility of the seat rocking. A truly spherical brass to iron ball joint assures permanent tightness without jamming.

The Jefferson line includes 300# AAR, Enduro 300#, Excel 250#, Master 150# as well as either brass seat or All-Iron seat unions.



*Ask your nearest distributor or get in touch with us direct for your requirements.*

**Jefferson UNION CO.**

605 W. 26th St., New York 1, N. Y.
63 Gooding St., Lockport, N. Y.
39 Fletcher Ave., Lexington 73, Mass.

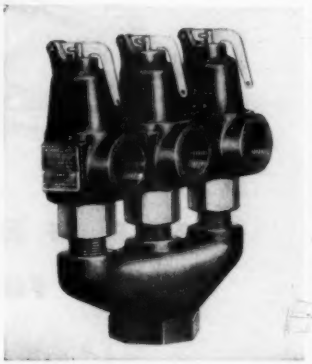

# More EQUIPMENT NEWS

Begins on page 158

parent, colorless liquid protects against water and moisture, but does not alter surface appearance in any way. It can be applied by brush or spray, and only one coat is needed.

**Monroe Co, Inc, Dept M-1, 10703 Quebec Ave, Cleveland 6, Ohio.**

For more data on these items, use post cards, p167. Identify request with P and number.



### RELIEF VALVE P837

Assemblies consisting of two or three *Series 33* safety relief valves have been developed for safeguarding larger hot-water heating boilers from excessive pressures. *ASME Boiler Code* recommends equipping hot-water heating boilers with relief valves having tested and rated discharge capacity equal to gross Btu output of boiler. This requirement is met by the firm's No. 33 relief valve for boilers having a gross output up to 242,900 Btu per hr—about 70% of all hot-water boilers. The assemblies have been developed for the remaining 30%, or larger boilers. They give a discharge capacity equal to the sum of the capacities of two or three valves; No. 233, 496,700 Btu per hr, No. 333, 769,400 Btu per hr. Assemblies consisting of proper size valves and manifold are packaged, completely made up and ready to install.

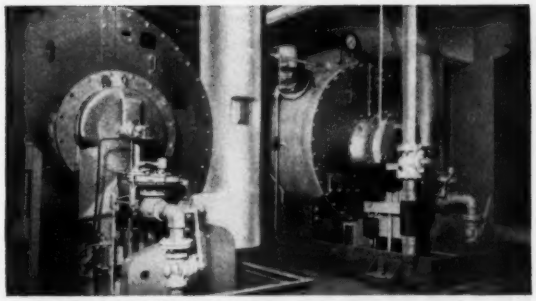
With these assemblies, when boiler pressure reaches 30 psi only one valve opens, and only enough to take care of normal thermal expansion. If, however, a "runaway" firing condition occurs, causing steaming and excessive pressure, the two or three valves open in progressive succession, providing full-rated discharge capacity of the assembly.

**McDonnell & Miller, Inc, 3500 N Spaulding Ave, Chicago 18, Ill.**

### WATER REPELLENT P813

Masonry, which normally absorbs water the same way a blotter does, actively repels it when treated with *Siliphane*. This transparent product is easily brushed or sprayed on exterior above-grade masonry walls of all types, including cinder block, concrete, brick, limestone, and asbestos shingles. It

*"The Boiler-Room? — On the Roof, Sir"*



The "First of Tulsa" Boiler Room — Two Cleaver-Brooks 200 hp. Gas Fired Boilers

# Boiler-Room in the SKY..

Boiler Room Directly Behind Roof Sign

FIRST NATIONAL BANK OF TULSA
TULSA, OKLAHOMA

Carson & Lundin, *Architects*
Gaynor & Albright
*Mechanical Engineers*
John W. Harris & Associates
*Supervisory Contractors*
Manhattan Construction Co.
*General Contractor*
C. Wallace Plumbing Co.
*Heating, Ventilating & Air Conditioning Contractor*

## FURTHER PROOF OF CLEAVER-BROOKS BOILER FLEXIBILITY

The new $6,000,000 First National Bank of Tulsa, one of the finest buildings in the Southwest, is heated with Cleaver-Brooks Self-Contained Steam Boilers.

For very good reasons the boiler-room was placed at roof level. (Boiler-room is directly behind roof sign at top of building, instead of conventional location in basement.) First, since it was a bank building, basement space was extremely valuable for vaults, storage, and air conditioning equipment. Then, too, with the fresh air intake on the top of the building, a considerable amount of piping was eliminated by placing the boilers at the same point. Since Cleaver-Brooks boilers require only a simple vent for carrying off combustion gases, long stack runs were eliminated, leaving additional valuable space within the building.

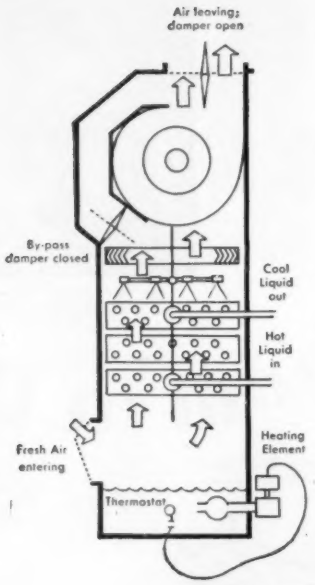
These are just a few of the many reasons why Cleaver-Brooks boilers were specified. Being completely self-contained and compact in design, requiring minimum head room and floor area, Cleaver-Brooks boilers presented no installation problem.

Cleaver-Brooks Self-Contained Boilers are available for oil, gas, combination oil and gas firing, 15 to 500 hp, 15 to 250 p.s.i., for heating and processing loads. Write for the catalog.

CLEAVER-BROOKS COMPANY
332 E. Keefe Avenue • Milwaukee 12, Wis.

**Cleaver-Brooks**
**STEAM BOILERS**
*The First and Finest of their Class*

# NIAGARA Aero Heat Exchanger




*U. S. Reissue Patent Nos. 22,533 and 22,553*

1. Extends quenching capacity without extra water or cooling tower.
2. Quickly pulls down heat at initial peak load of Quenching.
3. "Balanced Wet Bulb" Control holds quench bath at proper temperature, heating if needed to start after shut-down, and cools or heats by automatic control.
4. Saves cleaning expense as compared to cooling tower which picks up acids and fumes from air.

| APPLICATIONS | USED IN THE MANUFACTURE OF OVER 400 PRODUCTS INCLUDING |
|---|---|
| Quench Oils | Aluminum, copper, steel, nickel and alloys. |
| Cutting Oils | Diesel, aircraft, automotive and other engines. |
| Lubricating Oils | Chemical processes, plastics, adhesives. |
| Cooling water and brine | Gears, bearings, forgings and castings. |
| Cooling gas and compressed air | Wire, controls, electronic products. |
| | Ammunition, explosives, shells, ordnance, firearms. |
| | Farm machinery, tools, hardware. |

*For help in increasing production, saving of cooling water, write for Bulletin #120. Address*

**NIAGARA BLOWER COMPANY**

Over 35 Years' Service in Industrial Air Engineering

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## More EQUIPMENT NEWS

Begins on page 158

works on an entirely different principle from previous types of transparent waterproofing and is a product of the chemical silicone. It is not a surface film that seals the pores of the masonry and prevents breathing. Rather, it penetrates deeply and coats each part of the masonry with a microscopically thin water-repellent film. **Prima Products, Inc, 10 East 40th St, New York 16, N. Y.**

For more data on these items, use post cards, p167. Identify request with P and number.

### UNIT OIL COOLER P810

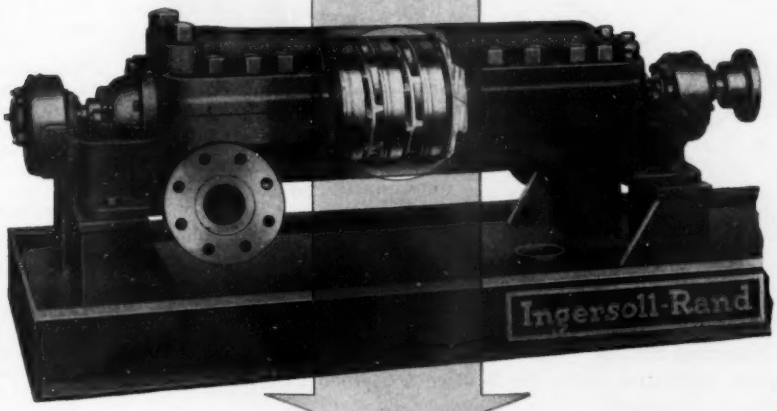
Compact nonferrous tube-and fin-constructed oil cooler has its cooling element supported by a special spring suspension to eliminate damage from expansion and contraction. Casing is welded steel construction for ruggedness and freedom from objectionable vibration and noise. A patented agitator is said to increase heat transfer between cooling air and oil by breaking up the oil flow in such a manner that it constantly wipes the tube surfaces for maximum heat transfer. Device is guaranteed for oil pressures up to 150 psi. **Young Radiator Co, Racine, Wis.**

### SMOKE DETECTOR P829

Designed for protection of spaces or hazards involving slow-burning or smouldering fires that generate too little heat to operate standard thermal or heat-activated detecting equipment, the *C-O-Two* smoke detector is a small chamber that contains photoelectric cells into which a constant stream of light is projected. Air samples from the protected area enter this chamber and if they carry any smoke the smoke particles reflect light from the steam. This actuates a galvanometer-type relay to give off audible and visible warning signals. **C-O-Two Fire Equipment Co, U. S. Highway No. 1, Newark, N. J.**

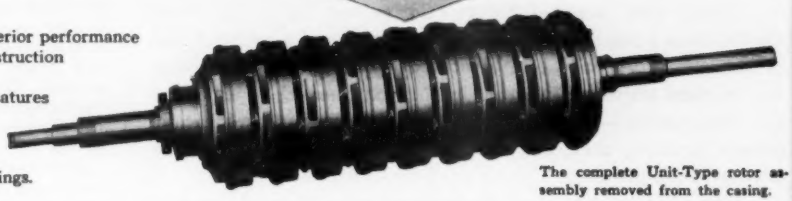
# . . . here's the INSIDE STORY

## on how the distinctively new HMTA can cut your high pressure pumping costs




A three-inch, nine-stage HMTA pump, with section of the casing cut away to show the rotor assembly installed.

● When it comes to superior performance and economy, it's the construction of a pump that counts. That's why the modern features of the Ingersoll-Rand Class HMTA pump mean so much to you in terms of long-range savings.



The complete Unit-Type rotor assembly removed from the casing.

**SIMPLE, UNIT-TYPE ROTOR ASSEMBLY.** Impellers, renewable wearing rings and stationary channel rings, containing the multiple volute fluid passages, make up the compact rotor assembly. Interstage sealing rings, compressed between the casing and channel rings, give a positive, metal-to-metal seal between successive stages. All rotor assembly elements are perfectly matched and self-aligning.

**HIGH SUSTAINED EFFICIENCY.** Multiple volute design, in-line staging and positive, interstage sealing contribute to the high efficiency of these units. And practical running clearances—proportioned for minimum wear—sustain this efficiency over years of service.

**RUGGED CONSTRUCTION.** The high-strength, symmetrical casing, is free from crossovers or cast volute passages. Complete radial and axial balance assures trouble-free operation over the complete range of pressures and capacities.

**COMPACT, ACCESSIBLE DESIGN.** The entire rotor assembly can be removed from or installed as a unit in the horizontally-split, smooth bore casing—without disturbing the piping. And the balancing drum, which is the only high pressure breakdown in the pump, can be inspected without opening the casing.

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Cameron Pump Division 590-10
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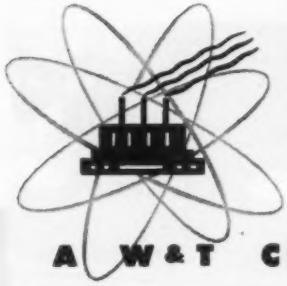
**HMTA**

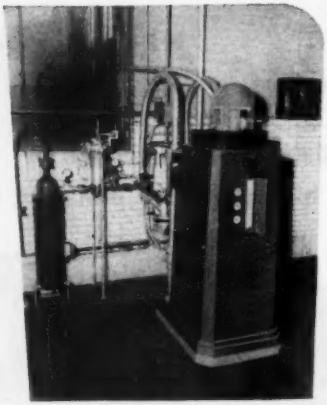
for pressures up to 1400 psi

Ingersoll-Rand Class HMTA pumps are available in capacities to 1600 gpm and pressures to approximately 1400 psi. For complete information on these *distinctively new* multi-stage pumps, write for your copy of Catalog 7233. Or ask your nearest Ingersoll-Rand branch office to give you the complete HMTA story.

COMPRESSORS • ROCK DRILLS
AIR TOOLS • CONDENSERS
DIESELS • GAS ENGINES
CENTRIFUGAL PUMPS

# SAXTON'S SECRET WEAPON . . .





W&T Chlorinator Installation at Saxton Station

## A W&T CHLORINATOR

In winning their battle against condenser slime at the Saxton Generating Station, Pennsylvania Electric Company, in their company publication, called the Wallace & Tiernan Chlorinator their "Secret Weapon."

Here's what happened before chlorine was tried. Experience showed even a small accumulation of slime caused a one inch loss in condenser vacuum — equivalent to a five to ten per cent reduction in plant efficiency. Frequent mechanical cleaning — expensive and disagreeable — still left a thin layer of slime. Cleaning compounds involving acids and alkalis were found an unsatisfactory answer to the problem.

Then Chlorine was tried! Preliminary tests indicated that coal consumption could be decreased by about $75 per day. *But,* feeding chlorine without special equipment proved both expensive and dangerous. A slight variation in feed rates resulted either in insufficient treatment or excessive chemical costs.

As a result of these tests, a Wallace & Tiernan Automatic Chlorinator was installed at Saxton in May 1949. This precision chlorinator made possible reduced coal consumption and virtual elimination of mechanical tube cleaning — the reasons why a W&T Chlorinator is Saxton's "Secret Weapon."

Hundreds of power plants have had benefits similar to those at the Saxton Station. Your W&T Engineer is prepared to help solve your slime problems — why not write for more information today — no obligation, of course.

CD-36

**WALLACE & TIERNAN PRODUCTS, INC.**

CHLORINE AND CHEMICAL CONTROL EQUIPMENT

Belleville 9, New Jersey • Represented in Principal Cities


## More TECHNICAL BRIEFS

Begins on page 154

tribution system and the load.

They discuss various main phases of the problem and the allowable limits. They feel that a simple distribution system with time-current and machine-differential-relaying will, because of its simplicity, contribute more to power continuity for industrial plants than will a less adequately maintained elaborate system. *AIEE paper No. 51-248.*

PROBLEMS CONFRONTING THE DESIGNER IN STARTING LARGE MOTORS, *by C M Lathrop and C E Schlecker, Standard Oil Development Co.* With the trend in chemical and petroleum processing industries toward more electrification of prime movers, a problem has grown on starting large motors. This problem is no respecter of system capacity. As an example, the fluid catalytic cracking process in the petroleum industry is a popular one and among the major power consumers is the air blower and gas compressor found in this type of unit. It is not unusual to find a 1000-hp motor or larger on a system having a total demand of only 4000 kw.

The larger the motor and the smaller the system capacity, the more difficult the starting problem. Even with specially designed motors with especially low inlet current, voltage drop can be appreciable. This sudden drop can seriously affect lighting facilities, increase system current flowing to other motors already operating on the system.

Quite apart from these factors are several intangible ones, such as damage to the distribution system by transient overvoltages created by a sudden change in line voltage.

The authors discuss the approach to fitting an individual large motor to an existing system. They suggest first determining if the expected drop is within the system's allowable limits. Then find if it is acceptable to the motor and its load-starting requirements. For purposes of this discussion they assume it has been determined that a 15% voltage drop is acceptable from the system's point of view. Then they follow through on this same case and supply several calculations, plus proper torque, speed characteristics and motor characteristic illustrations to support their discussion. *AIEE paper No. 51-251.*

*Directions for ordering papers on p 156*

## Water Treatment

DEVELOPMENT OF ORGANICS FOR WATER TREATMENT, *by J A Holmes, National Aluminate Corp.* For many years, organic materials, such as tannins,

IN TIMES LIKE THESE...

# Where pipes meet permanently...

YOU NEED

## WATSON-STILLMAN

FORGED STEEL

SCREWED AND SOCKET-WELD FITTINGS

SCREWED FITTINGS . . . are designed with ample metal sections. The wall-thickness is faithfully observed in final manufacture. Extra long bands extend well beyond the last thread, providing reinforcement at points of severest strain. Threading — is long, accurately cut, and perfectly aligned to insure tight joints. All fittings are properly chamfered to protect thread and afford easy entrance of the pipe.

SOCKET-WELD FITTINGS . . . just slip over end of pipe and weld. Deep socket supports and aligns pipe, eliminates tack welding and the use of special fixtures. Accurate measuring and cutting of pipe unnecessary . . . Ample come and go. No welding icicles inside pipe — no clogged lines. Wall sections 1¼ times the nominal pipe thickness permits proper heat penetration and correctly proportioned fillet weld.

Basic materials are selected from a wide choice of carbon, stainless and alloy steels. Drop forging and precision machining makes these light in weight, assures accuracy of finish, and all are instrument inspected for perfection of threads, sockets, angles and concentricity. Write for Bulletin A3-50. For information on Stainless and Alloy Steel Fittings, Bulletin S-1.

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Designers and Manufacturers of Forged Steel Fittings, Valves, Wire Rope Shears, Hand Pumps, Jacks, Pipe Benders and Hydraulic Equipment

MORE POWER
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*Lower operating costs*
*Lower fuel consumption*

If keeping pace with increased demands for more power has taxed your present plant facilities to capacity, call on a Ferguson First Team—qualifed power plant engineers, designers and builders—men who work efficiently together and *with your organization* — men who know your problems, have solved similar ones for others.

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**Careful consideration** *is given to basic power plant design so as to facilitate a progressive expansion program.*

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PRELIMINARY DISCUSSIONS IN CONFIDENCE and WITHOUT OBLIGATION

## More TECHNICAL BRIEFS

Begins on page 154

starches and other plant extracts, have prevented scales and corrosion caused by water used in industry. These were satisfactory until some time in the 1930s when higher boiler pressures and water temperatures made it necessary to develop better organic materials.

Since then the uses of organics have been classified and various ones have been selected according to their value for special purposes, rather than using one material for all purposes. This paper describes how research has been carried out to identify these organics and their specific field of use. *MWP paper. No number.*

ORGANIC SYNERGISTS IN FOAM CONTROL, *by C M Bodach and L O Gunderson, Dearborn Chemical Co.* Tannins, waste sulfite liquors, and other organic materials have long been recognized in boiler feedwater treatment. Of these, no one in itself has any appreciable antifoam properties under the conditions used. There is a definite need for antifoam treatment, however, since entrainment of boiler water in steam leaving the boiler results in a series of problems well-known to power men.

In recent years, efficient, long-lived, organic anti-foam agents have been developed. Among the outstanding are certain of the polyamides.

Tannins have a powerful synergistic effect when incorporated with polyamide antifoam. When results with the polyamide antifoam are indifferent, the addition of tannins greatly improves antifoam efficiency. This improvement took place in spite of the fact that the tannins themselves have no significant antifoam properties. *MWP paper. No number.*

Directions for ordering papers on p 156

USE AND MISUSE OF ORGANIC WATER-CONDITIONING MATERIALS, *by R W Liddell and L C Bishop, Hall Laboratories, Inc.* In recent years most of the operator's troubles with hard scale in boilers have disappeared because of better external water softening and internal treatment with phosphate chemical. In some boilers, however, a new problem has come up. Instead of hard scale, a much softer material called sludge may be found in tubes. Sometimes this sludge becomes so heavy it completely blocks off a tube and no water circulates through it. Eventually the tube becomes so hot it bursts.

There are a number of ways to correct this sludge trouble. Softening of the water may be further improved, mechanical changes may be made in the boiler to improve circulation and give

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NOW YOU CAN clean electric motors, generators and turbines *without solvents!* The new Pangborn AC-4 Blast Machine scours armatures, parts, frames, coils, etc. with soft (20-mesh) corncob grits.

Since no liquids are used there is no need for drying periods and toxic or explosive hazards are eliminated. Large equipment can be cleaned *in place* and no residue is left to create gum or to break down insulation.

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New Pangborn AC-4 Blast Machines operate from a standard 40-pound air supply. Material costs average 1/10 of other methods and complete cleaning is finished in half the time.

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*Look to Pangborn for the Latest Developments in Blast Cleaning and Dust Control Equipment*

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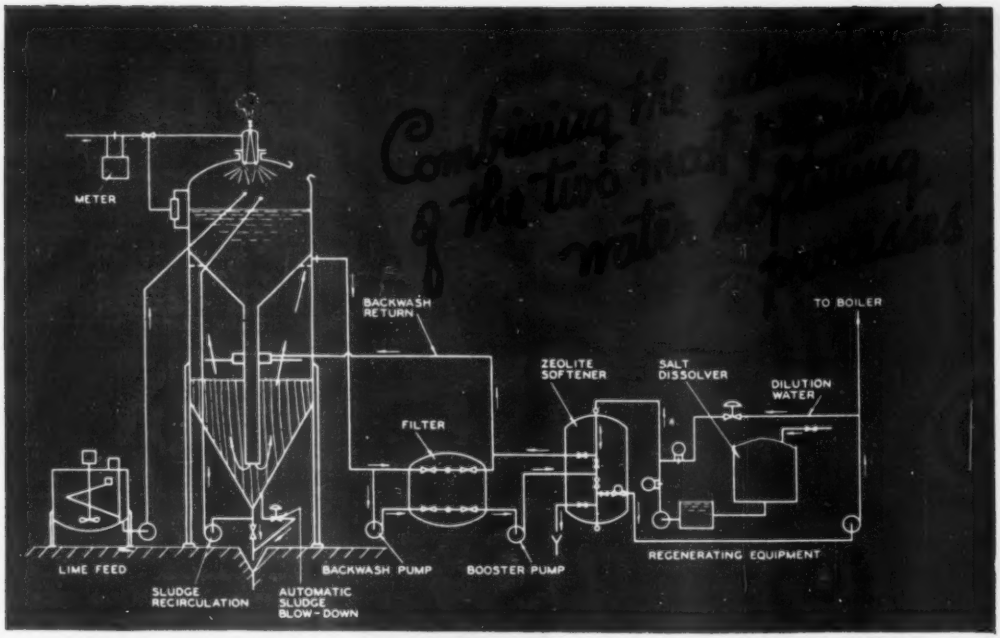
BLAST CLEANS CHEAPER
with the right equipment
for every job




# COCHRANE HOT PROCESS ZEOLITE SOFTENER

**1. saves chemicals**
The zeolite softener uses salt instead of the more expensive soda ash and phosphates, bringing down the cost of chemicals considerably.

**2. saves on capital investment** The cost of adding zeolite equipment to a hot process installation is far less than the addition of an independent sedimentation tank and chemical feed for a two-stage phosphate process.

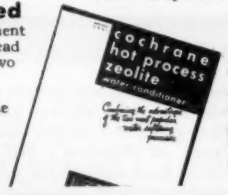
**3. lower $CO_2$ in steam**
The lower alkalinity resulting from using lime alone, plus the fact that this alkalinity is all carbonate, causes a reduction in $CO_2$ generated in the steam.

**4. less operating attention** The use of the zeolite softener with its simplicity of operation is an advantage which is enhanced by the longer periods between regenerations, due to the lower hardness of the hot process softener effluent.

**5. less floor space and head room required**
The addition of the zeolite equipment requires less floor space and less head room than that required for two stage phosphate equipment.

**6. lower alkalinity** The use of lime (or Dolomitic lime) as the sole reagent in the hot process means that the alkalinity can be reduced to about half that obtained with lime and soda ash.

**7. only one chemical needed in the hot process** It is generally possible to use a single reagent in the hot process, namely lime or Dolomitic lime, precipitating the bicarbonates and magnesium, leaving the remaining hardness to be removed by the more economical zeolite.

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# COCHRANE

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BOILERS BY BIGELOW

**Some Typical Installations of Boilers By Bigelow**

**PETER PAUL, INC.,** Naugatuck, Conn.
8,000 lb. per hour . . . oil fired

**HOTEL DENNIS,** Atlantic City, N. J.
14,000 lb. per hour . . . oil fired

**GALLO WINERY,** Modesto, Calif.
26,000 lb. per hour . . . oil and gas fired

**AURORA GASOLINE,** Detroit, Mich.
35,000 lb. per hour . . . oil fired

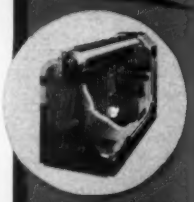
**THE STANLEY WORKS,** New Britain, Conn.
50,000 lb. per hour . . . oil fired

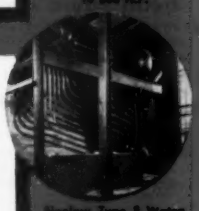
**BARTGIS BROTHERS,** Ilchester, Md.
60,000 lb. per hour . . . coal fired

**ST. MARY'S SUGAR,** Sorel, Le.
45,000 lb. per hour . . . Bagasse

**INTERNATIONAL SILVER CO.,** Wallingford, Conn.
30,000 lb. per hour . . . oil fired

**BEST FOODS,** San Francisco, Calif.
40,000 lb. per hour . . . oil and gas fired





Throughout industry, Bigelow boilers are piling up service records of efficient steam production. Each successful installation is further evidence of Bigelow's boiler-making experience. Each is operating proof of Bigelow's ability to build boilers to answer a wide range of steam requirements.

Every one of the hundreds of Bigelow boilers holding down vital power jobs is another reason for you to consider Boilers By Bigelow for your plant.

Write for free catalogs on any of the units listed here.

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# More TECHNICAL BRIEFS

*Begins on page 154*

better mixing of incoming feedwater with the boiler water, or other chemicals may be added.

The organic chemicals are among the other chemicals referred to above that may be added to water. They do their work by keeping the sludge suspended in the water and preventing it from forming harmful deposits. *MWP paper. No number.*

*Directions for ordering papers on p 156*

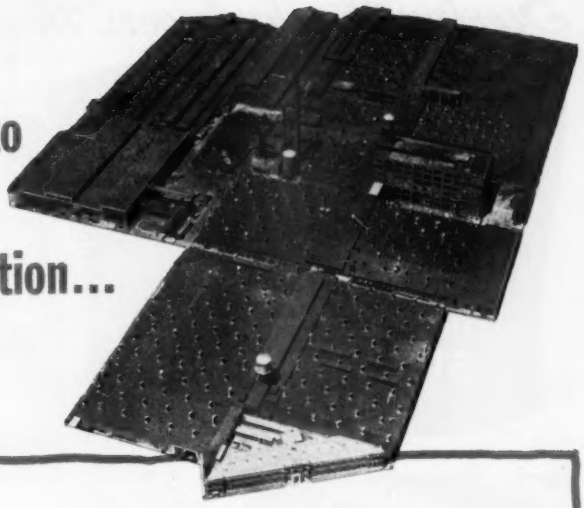
## Piping and Tubing

FIELD INSPECTION OF BOILER TUBES WITH ULTRASONIC REFLECTOSCOPE, *by JA Tash, Duquesne Light Co.* Repeated failure of defective superheater tubes seriously threatened the continued safe operation of two new boilers on the author's company property. To prevent any further forced outages it was necessary that the defective tubes be found and removed. Of several nondestructive inspection methods considered, the ultrasonic shear wave method and the reflectoscope looked most promising. By this means 92 sections, representing over 1500 ft of defective tubing were detected and replaced. With the ultrasonic reflectoscope, the successful procedure was that reported by Moriarty at the ASME meeting, Sept 1950.

For inspection purposes the tube to be examined was wiped clean to remove loose dust and brushed with SAE 30 oil, which acted as a lubricant and lessened any minor surface irregularities or deposits so the sonic wave would be continuous between the searching unit and the tube. Oil also insured sonic contact of the searching unit with the lucite adapter. In examining tubular material as distinguished from plates where the sound path has a finite length, the presence of a defect in a tube is recognized not by a "pip," but by its movement across the oscilloscope screen as the searching unit moves circumferentially. *ASME paper, No. 51-SA-48.*

INFLUENCE OF FREEZING ON PUMP GROUND COIL CAPACITY, *by A D Kasadar and I B Fieldhouse, Armour Research Foundation, Illinois Institute of Technology, and R A Budenholzer, Illinois Institute of Technology.* During the past few years the Armour Research Foundation has conducted research covering both experimental and theoretical effects of the heat-pump problem, particularly as a practical heating and cooling device for all types of buildings. *MWP paper. No number.*

White takes the "highroad" to low cost roof protection...



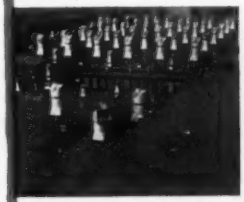
## with Carey Roofing Materials and FREE Roof Check Service

This aerial view of White Motor Company's huge truck plant in Cleveland puts a real problem into sharp focus—that of keeping *30 acres of roof* from sprouting leaks!

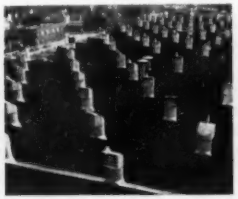
Since 1940, White has relied on Carey products and Carey's Free Roof Check Service to do the job at lowest cost. A job that's plenty tough in industrial Cleveland, where weather whips up its worst dishes and corrosive fumes "eat" roofs.

For proof that White's program for roof care *pays off*, check these facts: Guided by annual recommendations, prepared by Carey Roof Check Experts, White forecasts roof performance for the year ahead; corrects roof defects as recommended with Carey materials. Thus small troubles never reach major proportions—and yearly roof costs stay within bounds of the budget.

Whether *your* problem is one of roof design, replacement, repair or maintenance, it will pay you to consult with Carey. Backed by over 78 years' experience, and unrivaled research facilities, Carey products and services are the finest obtainable—cost less in the long run. Call your Carey Industrial Sales Engineer or write direct.



Patented Carey Enamel Clad process used to cover worn-out slate roofs at White Motor Company's plant in Cleveland, Ohio.



Where artificial light is always in use, skylights are covered by the Carey Enamel Clad system. This eliminates costly labor for cleaning and replacing windows.

Built-up roofing at the White plant is maintained in prime condition by tough, long-lasting Careyclad and Carey Fiber Coating—especially formulated to withstand the grinding abrasion of weather and corrosive fumes.

**TAKE ADVANTAGE OF CAREY'S FREE ROOF CHECK INSPECTION SERVICE**

The Carey Roof Check Method is backed by more than 78 years of field experience by Carey roofing engineers. Following inspection, you get a written report on the condition of your roof, the flashings, parapet walls, coping, gutters, etc., and recommendations for maintenance or repair. Write today for details.

**FROM THE HOUSE OF CAREY**

Built-up Roofing • Careystone Roofing and Siding • Super-Light 85% Magnesia Insulation • Careyduct Asphalt Plank • Asphalt Paints and Coatings • Industrial Flooring • Other famous products for industry.

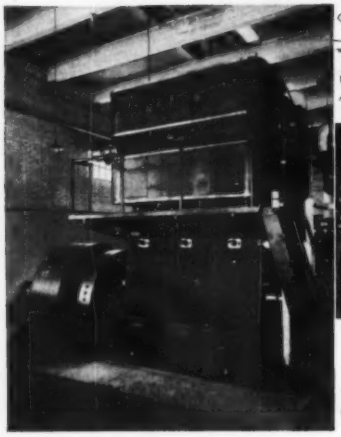
Carey

The Philip Carey Mfg. Company, Lockland, Cincinnati 15, Ohio. In Canada: The Philip Carey Co., Ltd., Montreal 3, P. Q.

# Saving the Taxpayers' Money

in Public Building Power Costs with

## SKINNER "UNIVERSAL UNAFLOW" STEAM ENGINES



One of two 200-Kilowatt Engines in State Hospital Plant.

Three-cylinder "Universal Unaflow" with 600-kw. D-C generator, in hospital.

**Public officials are saving money for the taxpayers all over the United States. Operating costs are being held down in public buildings of all types in which electric power is generated by Skinner "Universal Unaflow" Steam Engines.**

**The buildings are Federal, State, County, and Municipal. They include universities, colleges, training schools, high schools . . . hospitals, sanitariums, asylums, soldiers' homes . . . penitentiaries, prisons, reformatories, detention homes . . . state capitols, office buildings.**

**Skinner Engines drive generators to furnish power and light, and compressors for refrigeration. Exhaust steam is used for space heating, air conditioning, processing, and laundry. Their records for economical, dependable operation have been established over a period of four decades, in public institutions and private industries.**

***Write for case studies of what has been accomplished in industries similar to yours.***

*For Over 80 Years, Doing One Thing Well—Building Steam Engines*

**SKINNER ENGINE COMPANY, ERIE, PA.**


## ELECTRONICS

Continued from page 102

ondary 1*S*. Transformer primary 3*P* connected across this network energizes secondaries 3*S* that apply a potential to the grids of tubes $T_1$ and $T_2$. By controlling the current in dc coil *D* of the saturable reactor, the grid potential can be phase-shifted with respect to the anode volts. In this way tubes $T_1$ and $T_2$ can be made to conduct for any part of the anode voltage wave that gives the desired motor speed.

**Constant-Voltage Circuit.** Secondary 4*SH* that heats the cathode and secondary 4*S* that powers rectifying tube $T_3$ are energized from primary 4*P*. This tube supplies dc to the speed-control circuits at a constant voltage through voltage regulating tube *VR*. If we assume that the voltage is down through secondary 4*S*, current flows from the center tap *T*, through tube *VR*, resistor $R_{11}$ to cathode and top anode of $T_3$ to 4*S*. On reverse polarity the lower anode of $T_3$ and the bottom half of 4*S* conduct to give full-wave dc, which is filtered by capacitors $C_5$, $C_4$ and resistor $R_4$.

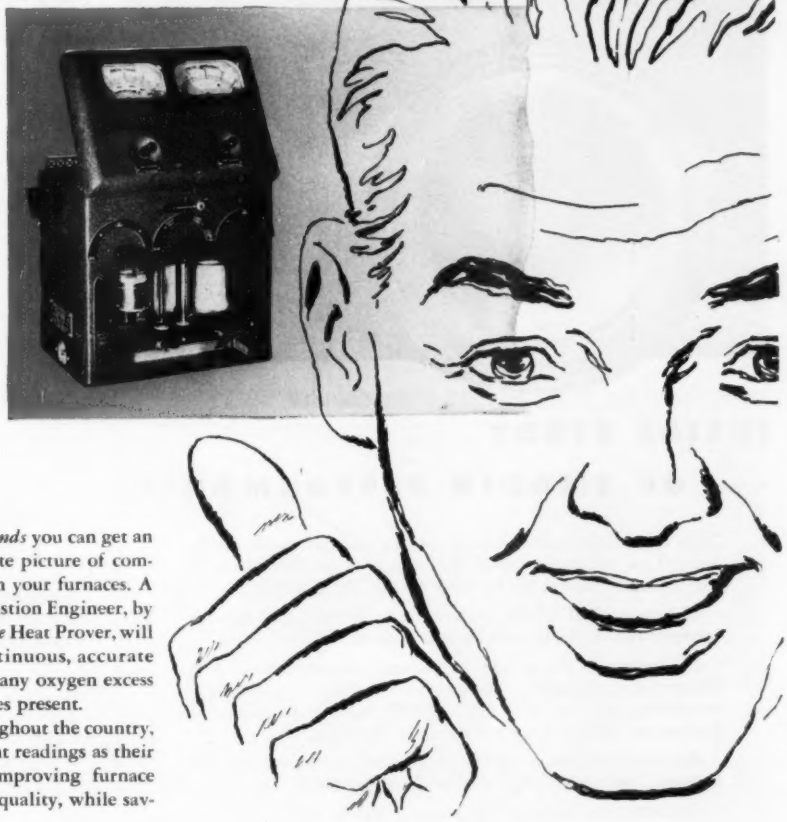
Voltage across *VR* is held at about 150 v and is applied across speed-regulating potentiometer *P*. This circuit is from center tap *T* on 4*S* through *P*, $R_{12}$ and $R_{11}$, 4*SH* and $T_3$. A tachometer generator, driven from the motor shaft, connects between contact *A* of the potentiometer and the grid of $T_5$, the lower half of the dual triode $T_4$ $T_5$. The tachometer is shown as a dc machine, but is an ac unit whose output is rectified to dc.

**Starting the Motor.** To put the motor in service the line switch (not shown) is closed. This energizes transformer primary 5*P* to heat the cathodes of all tubes and a timing relay begins to time out. After a specified time, contactors *M* and *LS* can be closed by pressing the start button. Before the motor starts, the voltage of the tachometer generator is zero. Under this condition the grid of $T_5$ is given a plus bias from *T* on 4*S* to the cathode and grid of $T_5$, through tachometer generator *G*, $R_{13}$, and $R_7$ to 4*SH*.

Tube $T_5$ then conducts maximum current from cathode to anode, through $R_6$ and to 4*SH*. Volts' drop across $R_6$ raises the potential on the grid of $T_4$ to where this side of the tube cannot conduct. This potential is applied from the right-hand end of $R_5$ through $R_9$, grid to cathode of $T_4$, through $R_8$ and $R_7$ to 4*SH*. Incidentally the voltage on the cathode of $T_4$ is limited to that across $R_5$.

Since $T_4$ cannot conduct there is no voltage drop across $R_7$ and the bias on tube $T_5$ is zero. This tube then conducts full current from cathode to anode of

# Not an instrument you buy... but a service we supply



Now *within seconds* you can get an accurate and complete picture of combustion conditions in your furnaces. A Cities Service Combustion Engineer, by applying his *exclusive* Heat Prover, will quickly secure continuous, accurate readings that reveal any oxygen excess or waste combustibles present.

Operators throughout the country, by using these instant readings as their guide, have been improving furnace output and product quality, while saving fuel.

Similar results are possible at your plant. Start the ball rolling today for a FREE Heat Prover test of your furnaces. Simply call or write your local Cities Service office . . . or else return the coupon below.

**THE COMPLETE CITIES SERVICE LINE FOR THE METAL FABRICATING INDUSTRY INCLUDES**

Chillo Cutting Oils — Trojan Greases
Trojan Gear Oils — Optimus Cylinder Oils
Pacemaker T Hydraulic Oils
Q-T (Quenching and Tempering) Oils

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

CITIES SERVICE OIL CO.
Sixty Wall Tower, Room 64
New York 5, N. Y.

Without obligation please send your booklet, "Combustion Control for Industry."

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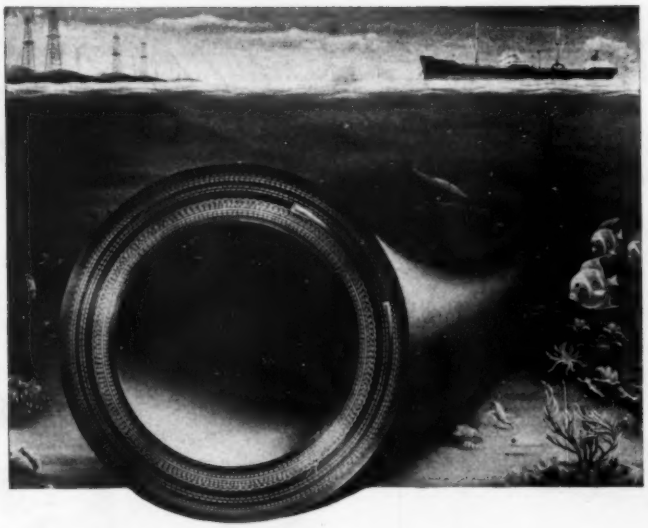
Address_____

City and State_____



INSIDE STORY

OF SMOOTH PERFORMANCE

Take another look at the inside of this undersea hose. It's as smooth as your garden hose, even though it is 12" in diameter and its walls contain heavy wires for additional strength.

It took a lot of skillful engineering to produce that smooth interior. *Hewitt-Robins was the first to do it.*

Because there are no wire ridges and no corrugations, turbulence is minimized . . . sediment can't collect . . . cleaning is simplified. And flow is as much as 50% faster than through a rough-bore hose of the same diameter and length.

Smooth-bore hose is one of a long list of basic advancements in hose construction originated by Hewitt-Robins.

For over a century, we have been building better hose and other industrial rubber products to facilitate the handling of fluid and solid bulk materials.

Today, we produce over 1000 different types of hose made from natural and synthetic rubber. Each is able to meet precise requirements—for flexibility and lightness; for resistance to abrasion, corrosion, erosion and shock; for ability to stand up under pressure and suction.

If you have a hose problem or need, come to hose headquarters.

HEWITT HR ROBINS

*Executive Offices:* 370 Lexington Avenue, New York 17, N. Y.

**HEWITT RUBBER DIVISION:** Belting, hose and other industrial rubber products

**ROBINS CONVEYORS DIVISION:** Conveying, screening, sizing, processing and dewatering machinery

**ROBINS ENGINEERS DIVISION:** Designing and engineering of materials handling systems

Hewitt-Robins is participating in the management and financing of Kentucky Synthetic Rubber Corporation

## ELECTRONICS

*Continued from page 194*

$T_6$, resistor $R_8$ cathode to anode of $T_6$, resistor $R_{10}$, the dc coil $D$ of saturable reactor $X$ and to $4SH$. Current through coil $D$ saturates reactor $X$ to shift the voltage on the grids of tubes $T_1$ and $T_2$ almost in phase with the anode volts. These tubes then conduct during practically all of the anode wave and the motor accelerates.

**Tachometer Generator.** As soon as the motor starts to run, the tachometer generator produces a voltage of the polarity shown. This generator tends to put a minus bias on the grid of $T_5$ from — on $G$ to the grid and cathode back to + on the generator. How high this bias can be depends on the setting of potentiometer $P$. If contact $A$ is on the minus terminal of $P$, full generator voltage is applied from grid to cathode of $T_5$ to — on $P$ and to + on $G$.

Since minus bias on $T_5$ grid is at a maximum, current flow through this tube and $T_6$ and coil $D$ of saturable reactor is at a minimum and ac impedance of $X$ will be near maximum. Grid voltage of $T_1$ and $T_2$ will be cause to lag the anode volts to where these tubes conduct for only a small part of the anode voltage wave, and motor speed will be at a minimum.

**Speed-Adjusting Potentiometer.** If contact $A$ is set on the + terminal of potentiometer $P$, voltage of generator $G$ is applied from grid to cathode of $T_5$ through the potentiometer back to $G$. Full-voltage drop across $P$ now opposes that of generator $G$ so minus bias on the grid of $T_5$ is at a minimum. This tube, as previously explained, will conduct full current as will $T_6$ and the dc coil $D$ of saturable reactor $X$. Grid bias on tubes $T_1$ and $T_2$ is phase-shifted so the tubes conduct for a large part of the anode-voltage wave, and the motor will come to top speed in the low-speed range. Thus by moving contact arm $A$ from — to the + on potentiometer $P$, any speed within the low-speed range may be had.

The tachometer generator also tends to hold the speed constant at any setting of the potentiometer. Assume the motor operating at a given load and speed. If the load decreases, speed would tend to increase and up the voltage of generator $G$. This raises the minus bias on the grid of tube $T_5$ and current flow through it, tube $T_6$ and dc coil $D$ of saturable reactor $X$ decreases. Bias on the grids of tubes $T_1$ and $T_2$ is phase-shifted to delay firing of the tubes to slow down the motor and hold speed constant at near the preset value. If the motor slows down because of a load increase, effects of the tachometer generator are to increase speed to normal.

# 1...2...3...4... 5...6...7...8 Big Reasons

why the

**B&G 1522 *Hydro-Flo* PUMP**

will better satisfy

your pumping needs

Plant engineers and maintenance men are astonished at the performance of the B & G 1522 Pump . . . because this unit licks the pumping jobs which usually cause trouble. For these reasons—

**First:** Leak-proof Mechanical Seal—ends stuffing box troubles.

**Second:** Spring-type flexible coupling—contributes to unusually quiet operation.

**Third:** Hydraulically balanced impeller.

**Fourth:** Easily serviced. Removal of a few bolts permits separation into three parts.

**Fifth:** Interchangeable parts. The bearing bracket sub-assembly, including shaft and sleeve bearings, is manufactured to close tolerances and is interchangeable in all 1522 Pumps.

**Sixth:** Shaft alignment maintained by extra long, oil-lubricated, high-grade bronze sleeve bearings.

**Seventh:** Standard motors—easily obtainable from motor manufacturer's local stocks.

**Eighth:** With all these features B & G 1522 Pumps are *competitively priced!*

B & G Series 1522 Pumps are available in all-iron, bronze-fitted, all-bronze and stainless steel units. Capacities to 130 GPM—heads to 115 ft. Write for catalog CY-350.

B&G

# BELL & GOSSETT

COMPANY

Dept. CD-36, Morton Grove, Illinois

*Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, Toronto, Canada*

*Reg. U. S. Pat. Off.

HEAT EXCHANGERS — FORCED HOT WATER HEATING SYSTEMS — WATER HEATERS — REFRIGERATION EQUIPMENT

# ALLPAX
## GASKET CUTTERS

**ALSO:**

Packing for all services; Valve Discs; Retainer Packing; Molded or Mandrel Cut Packing Rings; Packing Hooks.

***Send for:***

*Illustrated catalog covering the complete ALLPAX line. Consult nearest distributor for your requirements.*

**Any shapes, cut from any materials . . . quickly, easily and accurately**

This tool can prove invaluable to you—as a time and labor-saver, enabling you to cut your gaskets as you need them without wasting time or material. These precision tools quickly pay for themselves.

**New Improved ALLPAX Cutter—Priced at $26.00,** cuts holes from ¼" to 48" in such materials as felt, rubber, cork, asbestos sheet, etc.

**ALLPAX JUNIOR Cutter—Priced at $7.50—**cuts ¼" to 6" round, oval, square, or irregular shapes. All prices f.o.b. factory.

**THE ALLPAX COMPANY INC.**
805 Mamaroneck Ave., Mamaroneck, N.Y.



# Now! A New Safety Valve, Built on a Better Principle

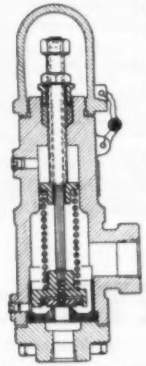
This improved equipment has the seat and moving parts of stainless steel; no danger of rusting fast! The parts are self-aligning and accurately made. The opening is full, giving the valve much greater capacity than earlier types

PATENT PENDING

The new valve can be reseated after it opens. It meets the requirements of the latest A.S.M.E. and A.S.A. B-9 Codes. Built in ½", ¾", 1" and 1¼" sizes.

Sensitive, dependable, and safe, this valve will give your refrigerating system the adequate protection you need.

*Order today from your nearest Frick Branch or Distributor, or direct from*



*New Valve has Many Advantages: see Frick Bulletin 193*

DEPENDABLE REFRIGERATION SINCE 1882
**FRICK CO.**
WAYNESBORO, PENNA. U.S.A.


## ELECTRONICS

*Continued from page 196*

**Minimum-Current Control.** Potentiometer $P_3$ sets the minimum current through dc coil $D$ of the saturable reactor and the minimum speed at which the motor can operate. This circuit is from tap $T$ on 4S through $P$, $R_{12}$, $P_3$, $R_{11}$ and $R_{10}$ to coil $D$. Current flow in this circuit is independent of what happens in $T_5$ and $T_6$. If we block these tubes there is still a minimum dc current flowing through coil $D$ to give a minimum selected motor speed.

If potentiometer $P_3$ contact arm $A_3$ is turned to full clockwise position, $P_3$ will be cut out of circuit, and current flow in coil $D$ will cause the motor to operate at top minimum selected speed. Turning contact arm $A_3$ to full left position cuts $P_3$ into circuit. Current flow through coil $D$ is now at a minimum as is also lowest selected motor speed.

Movement of arm $A$ on $P$ cannot reduce the speed below that set by $P_3$. It can only increase the speed above the minimum set by $A_3$, not below that value. Movement of contact $A$ controls only the minus bias applied to $T_5$ by the tachometer generator. Therefore, potentiometer $P$ adjusts motor speed between a minimum and a maximum low-speed range, while the driven machine is being made ready for full-speed operation. After the machine is ready to run, a button on the control is pressed to open contacts $LS$ and close $HS$. Speed is then regulated by the master controller positioning contacts $SC$ on the resistors $RS$.

**Control Applications.** This type of control is used on paperbag making machines, printing presses and similar drives where inching and threading speeds of 2 to 25% of rated value are required. Speed regulation in the low-speed range with electronic control is less than 1% when the load changes from 15 to 125%. Cost of this type of drive is in general less than for the standard 2-motor drive with a slow-speed gear and overrunning clutch.

*The author acknowledges with thanks the assistance that William Elliot, engineer, Cutler-Hammer, Inc., rendered him when he wrote this article.*

## More PLANT PROBLEMS

*Begins on page 134*

**STOP VIBRATION** at source. If it's bad enough to burn out lamps, it does machines no good either. I doubt if vibration is entire cause of quick burn-out. Voltage variation during motor starting can cut lamp life. If vibration can't be stopped at source, cushion each socket or fixture with a rubber gasket cut from ordinary sheet material.

With conduit outside walls, use rub-

# AVAILABLE FOR YOUR NEEDS . . . ANYWHERE

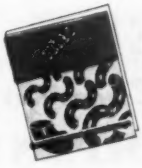
GLOBE TUBES

# GLOBE

## PRECISION-PROCESS SEAMLESS WELDING FITTINGS

Nation-wide availability through key distribution centers is yours when you specify Globe Welding Fittings.

For the finest in seamless welding fittings and a dependable source of supply, look to Globe and your Globe distributor.



For complete information on sizes and types, send for the Globe Welding Fittings Catalog.

Globe Steel Tubes Co., Milwaukee 46, Wis.

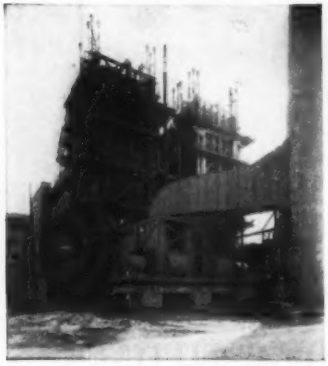
Chicago • Cleveland • Detroit • New York • Philadelphia
St. Louis • Houston • Denver • San Francisco • Glendale, Cal.

Producers of Globe seamless stainless steel tubes — Gloweld welded stainless steel tubes — alloy — carbon — seamless steel tubes — Globeiron seamless high purity ingot iron tubes — Globe Welding Fittings.

**GREEN FANS . . . Used by Many Leading Utilities**

One significant fact about Green Fan Installations at the New Orleans Public Service Plant is that two different boiler manufacturers were involved . . . two different types of boilers but Green Draft Fans for all three boilers. Each boiler has two Green Induced Draft Fans and one Green Forced Draft Fan.

When a concern has specialized on an important piece of power plant equipment for many years, that firm is rightly called the "authority" on the subject. This is the position of Green Fuel Economizer Co. in the field of mechanical draft fans. The name Green is synonymous with Draft Fans highly acceptable to industry.



The Line of Green Induced and Forced Draft Fans includes many types in many sizes which are described in Bulletin No. 168. We shall be glad to discuss your fan requirements with your own engineers, with your consulting engineers and with the boiler manufacturer of your choice.

THE GREEN *Fuel Economizer* COMPANY INC.

BEACON 3, NEW YORK

ECONOMIZERS • FANS • AIR HEATERS • CINDERTRAPS

## More PLANT PROBLEMS

Begins on page 134

ber or other soft materials to isolate vibration. Washers of same material under locknuts at pull boxes also help.

OLIN L BRACE *Spokane, Wash.*

**DROP CORDS,** six or eight inches long, could cure *YM*'s trouble. They absorb vibration, increase lamp life. Make up cord with male plug on one end and a lamp receptacle on the other. This is an inexpensive out for a costly situation.

CHARLES H ELBERT *Irvington, N.J.*

**NEAT TRICK.** We stop overheating and loosening of lamps by turning the washer on the base contact into a vertical position with a knife. Lamp is screwed into socket where it stays without further tightening.

C A WILKES *Oaklyn, N.J.*

**BEND SOCKET TONGUE OUT** slightly to stop lamp vibration in socket. This puts more compression on lamp. Make sure socket is rigid in fixture and that heat can escape from lamps enclosed by a globe.

J P MULVEY *Yonkers, N.Y.*

**CHECK VOLTAGE PEAKS.** Lamps are available for 115, 120 and 125 volts, the last always last longer. Find if vibration does cause failure. Some areas near trouble spot may be vibration-free. Place clear lamp in trouble spot and inspect with high-power magnifying glass. Filament usually fuses together, reducing resistance. Abnormal current burns filament.

Try dampening vibration with ¼ or ⅝ in. sponge rubber at points of fixture support. Check correct method of mounting lamps. Some manufacturers have a definite position for satisfactory operation. Tighten nearby fixture straps and conduits to keep transmitted vibration at a minimum. Replacing fixture socket with all-rubber weatherproof socket may reduce vibration. Direct shocks usually aren't as severe as constant vibration, which keeps filament wires in constant motion.

If bulb neck contacts porcelain or bakelite socket shell, heat and expansion may crack glass. Air enters and bulb takes on a milky color. These are called "leakers."

New 2000-hr lamps are ruggedly built, have long life. These may do trick where vibration is a troublemaker.

L FITZPATRICK *Jefferson City, Mo.*

**SIMPLEST CURE,** and most effective one, is either vibration-service or rough-service lamps. Vibration-service lamps are for use where high-frequency vibrations are present; rough-service lamps

# MAMMOTH *of the* MISSISSIPPI

Venice No. 2 Steam Power Station, Venice, Illinois

Following a report on the industrial power needs of the Union Electric Power Company area made by Stone & Webster Engineering Corporation, we were retained to design and construct this 400,000 kw Steam Power Station. The station, located at Venice, Illinois, on the banks of the Mississippi River, has established an outstanding record for efficiency and reliability.

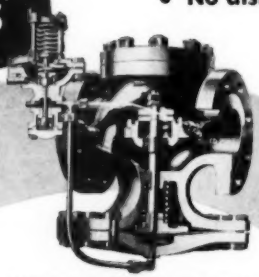
**STONE & WEBSTER ENGINEERING CORPORATION**

A SUBSIDIARY OF STONE & WEBSTER, INC.

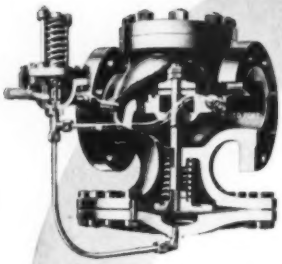
# SAVE WITH SPENCE on all these jobs

***Here are a few reasons why Spence Regulators give you accurate regulation and long, trouble-free life:***

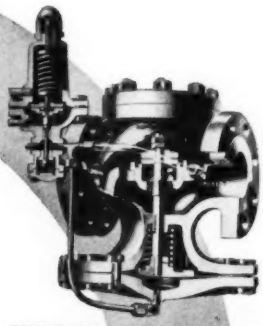
- **Single-seat Packless Construction**
- **Large Balanced Metal Diaphragm**
- **Sensitive Pilots**
- **SECO Metal Seats and Discs**
- **Springs out of path of steam**
- **No dismantling for inspection**



**PRESSURE REDUCING**—Self-operated, dead-end regulators powered by large, frictionless, metal diaphragms. Sizes ¼ in. to 12 in. Pressures to 600 psi 750 F.



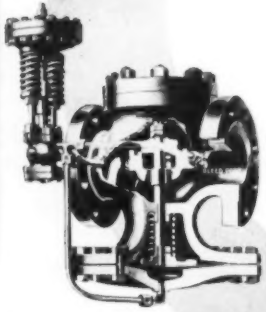
**BACK PRESSURE CONTROL**—Wide selection of sensitive pilots to meet exacting requirements. Initial pressure closing, guaranteed to shut tight. Packless construction, metal diaphragms.



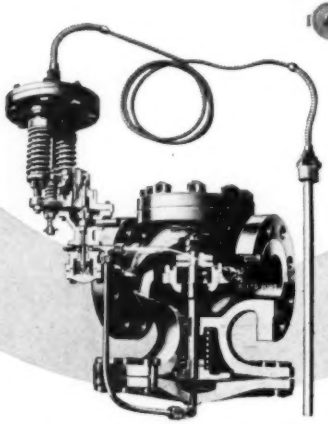
**DIFFERENTIAL PRESSURE**—Accurate control of delivery pressure at a constant, adjustable differential from 3 to 150 psi above another source of fluid pressure.

**WRITE FOR BULLETIN 350**

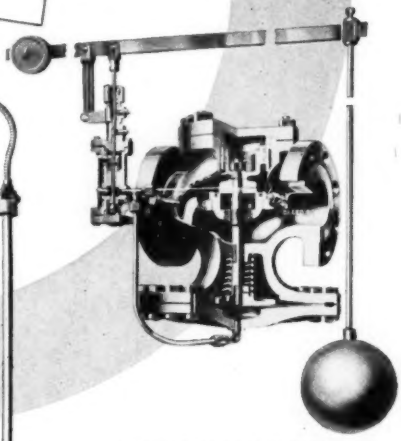
*for complete details on Spence's line of automatic regulating valves*



**PUMP GOVERNOR**—Constant or excess pressure control for steam pumps. Steam pressures to 600 psi 750 F, pump discharge pressures to 2000 psi.



**TEMPERATURE REGULATING**—Combined temperature and pressure control. No separate reducing valve required. Shuts tight, will not wiredraw or be damaged by overheating. Sizes to 12 in.



**LEVER OPERATED**—Pilot lever for connection by cable or mechanical linkage to floats or other devices. Slight actuator motion opens and closes main valve.

BE-113

**SPENCE ENGINEERING COMPANY, INC.**
**WALDEN, NEW YORK**

Spence

# A. P. GREEN

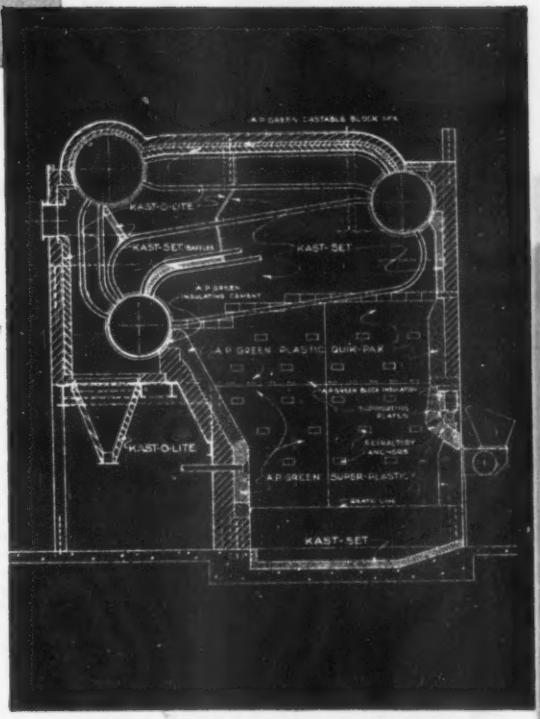
## ENGINEERED MONOLITHIC LININGS

# Provide More Efficient Furnace and Boiler Operation

A. P. Green produces plastic and castable refractories designed to meet the varying service conditions in different sections of industrial heating and power units. It has been proved both practical and economical to install a specific material to meet the condition in each section.

Complete monolithic linings can be installed quickly and easily. In monolithic construction, there are no exposed joints subject to attack by flame or slag — linings remain air-tight and do not bulge — longer service is obtained.

There is an A. P. Green refractory product applicable to each type of service requirement. A. P. Green produces SUPER-PLASTIC to meet certain extreme conditions — PLASTIC Quik-Pak to meet requirements of a high heat duty refractory — KAST-SET where a high quality refractory castable is desired — KAST-O-LITE for zones where a lightweight castable refractory with insulating properties is necessary.




*Typical application of A. P. Green plastic and castable refractories . . . forming a monolithic lining in a 3-drum low head boiler.*

The A. P. Green Fire Brick Company Engineering Department will assist you with further information on the application of these materials to new units or the conversion of existing furnaces. Call your local A. P. Green distributor . . . he's listed in the yellow pages of your telephone directory . . . or write . . .

A. P. Green REFRACTORY PRODUCTS

*Distributors in the Principal Cities of the World*

**A. P. GREEN FIRE BRICK COMPANY**

MEXICO, MISSOURI, U. S. A.

*A. P. Green Fire Brick Company, Ltd. in Canada*

# KENNEDY bronze gate valves...

## JOB-FITTED for low-cost maintenance

KENNEDY Fig. 27, Bronze Gate Valve, 125 lbs. steam, 200 lbs. WOG, non-shock

**TO ASSURE DEPENDABLE OPERATION** with minimum maintenance, the complete KENNEDY Line is *job-fitted* . . . every valve specially designed and engineered for the job it has to do.

**THE SIMPLE, STURDY DESIGN** of the rugged KENNEDY Fig. 27 Bronze Gate Valve, for example, eliminates the small, quick-wearing parts that can cause frequent repair expenses.

**EXTRA TIGHTNESS**, without undue wear on the packing, is assured by an unusually deep stuffing box. Stripping of the stem and disc threads is practically impossible. Ribs cast on inside of valve body fit into channels in disc to maintain straight-line operation of all moving parts.

**THE STUFFING BOX** is provided with gland, and the valve can be repacked under pressure when wide open.

**SCREWED BONNET AND WEDGE DISC** are standard on the Fig. 27 in sizes from ¼" to 3". Larger sizes are constructed with bolted bonnets and cam-type double discs with parallel seats. Working pressures ¼" thru 3": 125 lbs. steam, 200 lbs. WOG, non-shock. 3½" thru 6": 100 lbs. steam, 150 WOG, non-shock.

**TO SAVE TIME AND TROUBLE**, the Fig. 27 is *job-fitted* for easier installation, too. Wide, heavy pipe-end hexes have generous chamfer and precision threading . . . help you make tight connections quickly and easily.

**FOR BEST RESULTS** and real economy, standardize on KENNEDY Bronze Valves, and the complete line of KENNEDY Iron Valves, Malleable, Cast-Iron and Bronze Pipe Fittings.

*WRITE FOR CIRCULAR 102 . . . BUY FROM YOUR LOCAL DISTRIBUTOR*

THE KENNEDY VALVE MFG. CO. • ELMIRA, N.Y.

Est. 1877

VALVES • PIPE FITTINGS • FIRE HYDRANTS


## More PLANT PROBLEMS

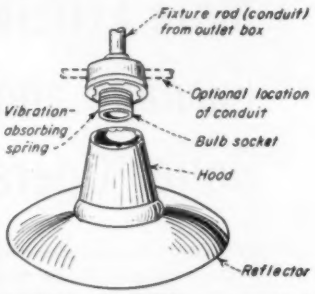
Begins on page 134

for places where you have shocks or jolts. In sizes above 25 watts, bulb is generally a size larger than a standard lamp. Sockets are identical. Test both types to find which is best for job. Damping of vibrations in fixture isn't too satisfactory.

DAVID H NOBLE *Wilmington, N.C.*

**VOLTAGE CHANGE** causes more trouble than vibration. With 120-v bulbs the filament gets too hot when voltage rises. If there is any vibration at this time filament breaks. I've more than doubled the life of our bulbs by replacing 120-v units with 130-v lamps of the same wattage. These give up to and even better than 3000 hours of life.

CARL A FREY *Chicago, Ill.*




**SEVERAL SOLUTIONS** are practical. Simplest is use of special bulbs. They last about 33% longer but don't burn as brightly. Vibration- and rough-service lamps cost somewhat more than general-service units.

Another way of doing job is outlet boxes, fitted with an internal spring. Fixture or fixture rod is attached to cover and vibration is absorbed in this way. Weight supported by spring is sum of bulb, reflector, bulb guard, socket, wire and fixture rod weights.

Third method uses shock-absorbing socket as in sketch *above*. *YM's* best bet is to try this socket with several different bulb types to see how long each lasts. Correct bulb that has right brightness and longest life can be easily selected.

A J BREUGELMANS *Hoboken, N.J.*

## MORE ON COAL JAMS

EDITOR'S NOTE: *Lack of space prevented publication of this answer in June.*

**SOLUTION** of *LS's* problem is simple and can be done nicely with standard equipment. Buy a swing-type switch from coal-scale manufacturer. Switch paddle rides on coal as long as it is flowing. When a jam stops coal flow to scale feeder, paddle swings to vertical position, sounds alarm. If desired, swing

# *Now* CMH *offers*

**a proved expansion joint for pressures up to 5500 psi**

Advancements in the design of the CMH FLEXONIFLEX Expansion Joint—the "proved-in-service" high pressure expansion joint—now make it possible to offer units for working pressures up to 5500 psi. For all power and process applications it means that the advantages of compact, easy-to-install expansion control may be used at pressures far beyond those which had previously been considered safe.

Standard FLEXONIFLEX units have bellows type stainless steel pressure carriers, single or multiple ply, lined or unlined with integral control rings and end sections. Sizes range from 5/8" through 6" I.D., although larger sizes can be furnished. Suitable for temperatures from sub-zero to 1600° F. (higher with special materials).

For specific recommendations send complete details of your application.

## OTHER CMH EXPANSION JOINTS

For low and medium pressure service you may take advantage of the same engineering skill that has developed FLEXONIFLEX units. CMH Controlled-Flexing Expansion Joints are available in copper or stainless steel for pressures up to 300 psi, sizes to 48" I.D. CMH Free-Flexing Expansion Joints are also available in copper or stainless steel for pressures up to 30 psi. sizes to 48" I.D. Larger sizes are available in both types for special applications.

Flexon identifies CMH products that have served industry for over 49 years.

## CHICAGO METAL HOSE Corporation

1301 S. Third Ave. • Maywood, Ill. • Plants at Maywood, Elgin, Rock Falls, and Savanna, Ill.
In Canada: Canadian Metal Hose Co., Ltd., Brampton, Ont.

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**ONE DEPENDABLE SOURCE**
**for every flexible metal hose requirement**

Convoluted and Corrugated Flexible Metal Hose in a Variety of Metals • Expansion Joints for Piping Systems
Stainless Steel and Brass Bellows • Flexible Metal Conduit and Armor • Assemblies of These Components

# . . . NEW Heat Saving Efficiency

MUNDET 85% MAGNESIA INSULATION provides maximum strength and resistance to vibration. Extra durability is built into this insulation. In pipe covering and blocks, it is precision manufactured on the latest type of automatic equipment to insure uniform standards. It does not "powder", settle or disintegrate. It is unaffected by steam or water leakage. It maintains an attractive, smooth finish. Precision pipe fit is assured, with no spaces left for the escape of heat. You benefit from the most modern manufacturing facilities for the production of heat insulation when you specify Mundet 85% Magnesia Pipe Covering and Blocks. *Write for new heat insulation Engineering & Specification Data Manual.*

## Mundet Cork Corporation

Insulation Division, 7107 Tonnelle Ave., North Bergen, N. J.

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JACKSONVILLE 6, FLA. 800 E. Bay St.
KANSAS CITY 7, MO. 1401 St. Louis Ave.
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NEW ORLEANS 16 315-25 N. Front St.
NEW YORK 17 331 Madison Ave.
PHILADELPHIA 39 856 N. 48th St.
ST. LOUIS 9 3176 Brannon Ave.
SAN FRANCISCO 7 440 Brannon St.

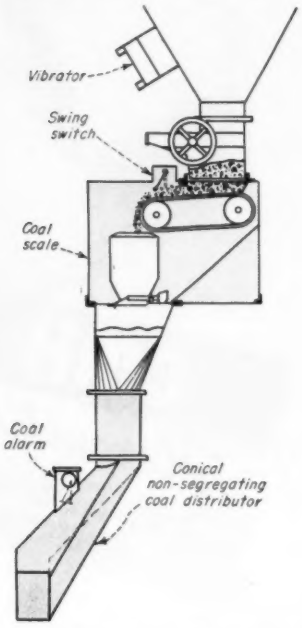
INSULATION FOR HIGH & LOW TEMPERATURE

## More PLANT PROBLEMS

Begins on page 134

switch can be arranged to automatically start a vibrator at bunker outlet when there's no coal on scale feed belt. It will also stop vibrator as soon as coal flow starts again. This eliminates noise of continuously-running vibrator. It also prevents packing of coal at bunker outlet. Many plants run well with this arrangement.

Similar alarm can also be installed on upper part of coal distributor; see sketch. As *LS* says, clearing bunker



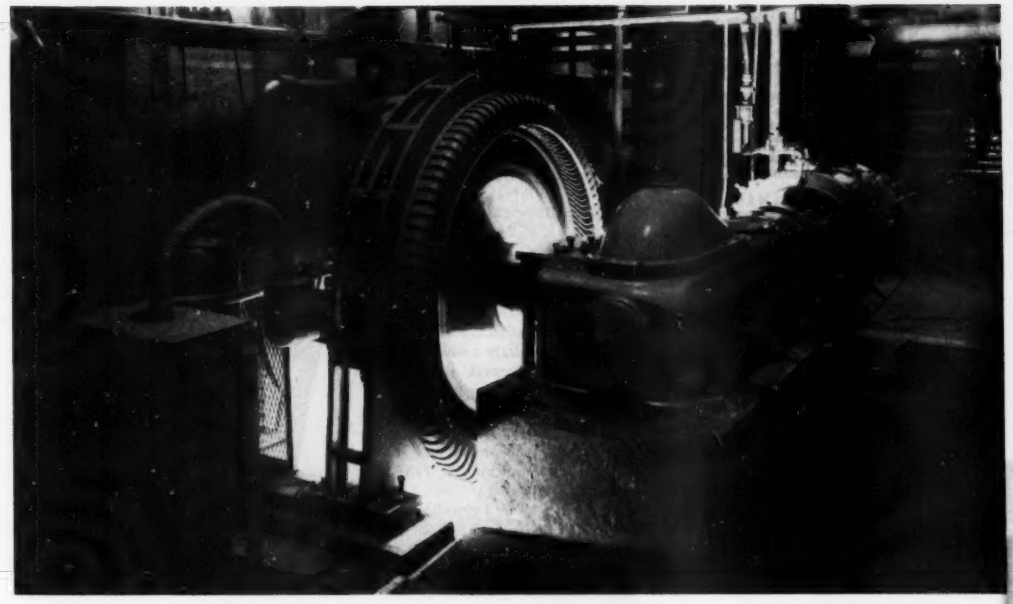

jams will probably stop downspout jams. But alarms in both places are useful. These units are standard equipment available from downspout manufacturer.

ARTHUR J STOCK *Cleveland, Ohio*
*Stock Equipment Co*

---

**General Electric Co** has received an order for a 180,000-hp wind-tunnel drive—the greatest power output ever concentrated on a single shaft—for installation at the National Advisory Committee on Aviation's Ames Aeronautical Lab at Moffet Field, Calif. The drive consists of four 45,000-hp 720-rpm variable-speed induction motors mounted in tandem on a single shaft to drive either of two axial-flow compressors.

**Westinghouse Electric Corp's** new plant at Union City, Ind., for ½- to 1/20th-hp motors will produce 75,000 units a month when it goes into production. The Small Motors Div has tripled its output.



# Here's the Perfect Partner for your Large Compressor

E-M

***Advantages for you to remember:***

1. You save money with E-M Engine-Type Synchronous Motors. No belts to buy . . . and space-saving direct mounting on the crankshaft puts installation cost at minimum. Full-voltage starting is economical. Soundly engineered, efficient design gives you lowest operating cost.

2. You're assured of long-life, trouble-free service. Frames of E-M Motors are heavy deep-section fabricated steel, reinforced and welded into a single unit. Wide rotor spokes have high torsional strength, and field poles are securely anchored with a liberal safety factor.

3. You can profit in performance and save in costs by contacting E-M early on compressor drive problems. For reliable, efficient service, E-M Engine-Type Synchronous Motors and Polarized Field Frequency Control are recognized as the *best* for any large compressor operation.

## *E-M Engine-Type Synchronous Motors are made-to-order for compressor drives*

● Linked hand in hand for dependable production at Parke, Davis & Company in Detroit (above) are the reciprocating air compressor and its most important working partner . . . an E-M Engine-Type Synchronous Motor.

The advantages you get in economical operation, space-saving installation and low maintenance costs have made E-M Engine-Type Synchronous Motors "perfect partners" for large reciprocating compressors.

This closely matched association of compressor and motor offers you significant benefits. These direct-connected motors, having only a stator and rotor, give you unbeatable simplicity, efficiency and low cost service. The E-M Polarized Field Frequency Control insures perfect synchronizing and complete motor protection.

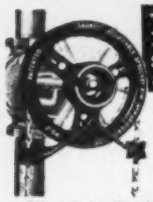
E-M engineers have met and solved compressor drive problems for nearly 40 years. As a result, they can design each E-M Engine-Type Synchronous Motor to match exactly specific compressor operating characteristics. Be sure to check E-M before you specify your next large compressor installation. Contact your E-M field engineer, or write the factory for E-M's 24-page booklet on Air Compressors . . . ask for Synchronizer No. 32.

ELECTRIC MACHINERY MFG. COMPANY
MINNEAPOLIS 13, MINNESOTA

1200-TPA-2098

E-M SYNCHRONOUS MOTORS AND CONTROLS FOR LARGE COMPRESSOR DRIVES

## FOR SAFETY'S SAKE
### Control Valves from the Floor



**Babbitt**
*Adjustable*
**SPROCKET RIM**
*with Chain Guide*

**ELIMINATES STEP-LADDER CLIMBING RISKS**

• Range of 10 adjustable sizes takes care of all valve makes and types; fits valve wheel diameters from 2 to 30 inches.

• Climbing on benches, machines, boilers or treacherous stepladders to control overhead valves is absolutely unnecessary, foolish risking of life and limb. Why permit such risks when the safe and sure BABBITT Adjustable Sprocket Rim with Chain Guide is available at such low cost? Overhead valves are conveniently and safely operated right from the floor!

• The BABBITT Adjustable Rim fits all valves, with either rising or non-rising stems. It is installed quickly by clamping onto the hand wheel of the valve.

• *Write today for Catalog Bulletin P, surprisingly low prices, and name of nearest distributor.*

**BABBITT STEAM SPECIALTY CO.**
**1 Babbitt Square, New Bedford, Mass.**

## For STRENGTH specify
# TRI-LOK
RECTANGULAR
## OPEN STEEL FLOORING

The locked-in strength of Tri-Lok enables it to stand up under heavy loads—even on long spans. Get maximum strength, air and light with minimum weight.

Tri-Lok is also available in Diagonal, or Super-Safety U-type Flooring, and in Stair Treads of all types. Write for Bulletin KM 1140.

The Tri-Lok Company is also equipped to furnish *riveted* and Tri-Forge *welded* open steel flooring. Tri-Lok can be furnished in a variety of metals, including aluminum alloy, stainless steel, etc.

**DRAVO CORPORATION**

National Distributor for the
Tri-Lok Company
Dravo Bldg., Pittsburgh 22, Pa.
Sales Representatives in
Principal Cities

DRAVO


## MARMADUKE

*Continued from page 146*

I ever shipped on," I told Mike coming off watch. Mike only grunted and got purple around his masthead.

"After a week Mike was ready to blow a fuse. He was itching to argue—but I never complained. That got him so jerky he started losing sleep. No one ever relieved him before without complaining—and he didn't know what to do about it.

"But I owed Mike a debt—and I'd pay him—with interest.

"In port the auxiliaries exhausted into the small auxiliary condenser. This was a small horizontal surface condenser with its waterbox connected directly to the circulating pump under it. The wet vacuum pump was in the opposite end with the steam end in the middle, in tandem, and it ran both pumps.

"The steam end was simplex, with a direct-acting slide valve. I knew shoulders on the valve chest and inside the cylinder, with bum piston rings thrown in for good measure, was the trouble.

"When the steam end stuck, no cooling water circulated through the condenser. Then the backpressure valve, set at 15 pounds, popped and the engine room filled with steam in no time. Each watch the pump got worse. The first assistant said he'd overhaul it at sea leaving San Pedro. But that was another six weeks off.

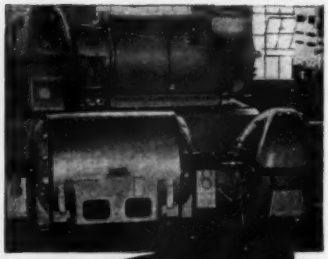
"Holding steam for sudden cargo winch demands on two boilers, watching the water, and keeping an eye on the engine-room auxiliaries was a full-time job for one man. So that condensate unit stalling was a headache.

"I got tired of running into the engine room. So I pulled an old operating trick and fixed that pump so it ran smoothly on my watch. Then I talked the 12 to 8 water tender into changing watches so Mike Brannigan took over from me.

"Mike was suspicious and for good reason. The slow, dull thump, thump of that pump could be heard or felt all over the ship. When it stopped suddenly, everyone aboard was conscious of it.

"When Mike came down the usual ten minutes early to check the plant before taking over, he was looking for trouble. He felt, smelled and gave everything a double check. He was sure I was up to something but he couldn't find a thing wrong. And that condensing unit ran like a ship's chronometer.

"Mike checked the pump's stroke, the exhaust cushioning valves, the valve links' movement, and he listened to the valve. He even checked the sea suction and discharge valves for being wide

## Give YOUR Equipment that New Look!

IF your diesels, generators, heavy equipment look a little the worse for wear—give them a quick rub-down with Oakite Renovator.

Mixed with water, Oakite Renovator combines both solvent and emulsifying cleaning action—goes after grime, oil, grease, smoke-haze, fingerprints in a hurry. Just wipe surfaces clean—then polish with a dry cloth to bring out high paint luster. No rinsing necessary. No fire hazard. Safe on the hands and pleasant to use.

**FREE MANUAL** tells all about it. Also describes 70 other ways to save time and money on maintenance. Discusses such jobs as

- **Descaling heat exchangers**
- **Degreasing repair parts**
- **Reconditioning filters**
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- **Removing rust**
- **Cleaning hard-to-reach places with Steam-Detergent Gun**

Copy yours for the asking. Call your Oakite Technical Service Representative. Or write Oakite Products, Inc., 23 Thames St., New York 6, N. Y.

SPECIALIZED INDUSTRIAL CLEANING
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*Technical Service Representatives Located in Principal Cities of United States and Canada*

# 2,574,000 TONS CRUSHED COAL

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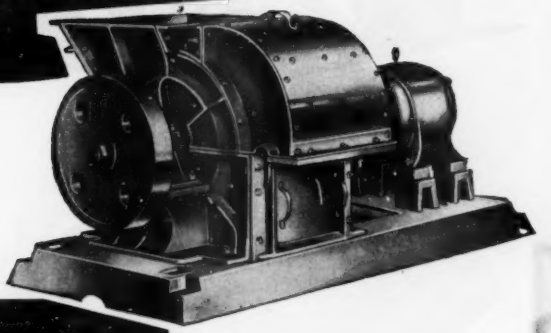


## 23 Year Old AMERICAN CRUSHER Now Ready for New Career

Far from being ready for retirement, the 23-year-old American Crusher, whose rotor is shown here, was recently overhauled and transferred to its new home at the Arkwright Mine in Morgantown, West Virginia—where it is now prepared to start a new and productive life.

PATENTED MANGANESE STEEL SHREDDER RINGS

Since 1927 this mechanical "old faithful" has reduced over 2½ million tons of 6-inch lump to minus ¾ inch screening—at a *total parts-replacement cost of only $.0007 per ton* (including the recent reinstallation costs).

Only such features as the exclusive, patented Shredder Ring—originated and perfected by American—could produce such long-lived, economical performance as shown in this typical case history. When you plan to purchase a coal crusher, plan to investigate the built-to-produce American Rolling Ring Crusher.

*WRITE for Bulletin "CRUSHING COAL AT LESS THAN 1¢ PER TON"*

**American PULVERIZER COMPANY**

*Originators and Manufacturers of Ring Crushers and Pulverizers*

1349 Macklind Ave.
St. Louis 10, Mo.

Your Maintenance Costs
*Will Be Lower With*
DART

Once a Dart Union is in place you can forget it. You'll have a drop-tight joint that *stays tight* — that never requires re-tightening and extra maintenance.

Why? Primarily because Darts are made with extra care. Seats, for instance, are both of a special bronze alloy — highly resistant to corrosion and pitting. And they're accurately machined then spherically ground to ensure wide, true-bearing joint surfaces. Finally, high-test, air-refined, practically indestructible malleable iron is used so body and nut can shrug off the toughest abuse in installation or use.

Try Darts! — you'll find the longer, *better* service means true economy.

**DART UNION COMPANY**
**Providence 5, Rhode Island**
*The Fairbanks Co. — Distributors*
Boston New York Pittsburgh

DART
UNIONS

## MARMADUKE

Continued from page 208

open. But everything was just right and the pump thumped along merrily, as it had all through my watch.

"I lay in my bunk aft, taking equal strains on all my bearings and making a complicated experiment in fluid-flow resistance from a bottle of Sandpaper Gin. All of a sudden I heard the pump stop. That was about a pint after Mike relieved me. Then that pump took to stopping every half pint or so.

"I wised up the 4 to 12 watch so he kept the unit running on his watch like I did. After a few days, Mike spent most of his watches barging through a cloud of steam, climbing on top of the boilers to the atmospheric valve, galloping down to monkey with the pump's valve gear and cursing a purple streak at the top of his voice. The pump never stopped on our two watches—only on Mike's.

"'Look here, Mike Branigan,' yelled the First after a few watches. 'How in hell is it that pump stops only on your watch? What in the hell do you do, put the evil eye on it?'

"Mike sputtered and fumed, finally blurted, 'It's me *watch*, First. Give me the 4 to 12 and she'll run.' The First didn't argue, he changed Mike's watch. But again that pump stopped shortly after Mike came on. The end of each watch he'd come up red-faced, dripping sweat and muttering to himself.

"Mentioning that pump to Mike was fighting words. He got so hoppy he'd hang around the fireroom fiddley and engine-room skylights when off watch, rubbernecking below.

"On his new watch Mike had so much trouble he again asked to be changed. So again the First shifted our watches.

"But Mike no sooner took over his new watch than the pump stopped. And she had been thumping steadily along for the previous 16 hours. That was too much for even little Dan O'Hara, the chief engineer, who usually kept out of the engine room. He took off for below.

" 'What you doing to this Goddam pump, you thick-headed Harp,' yelled the chief. 'The minute you hit the floor plates she stops. If you don't know what you're doing, for Saint Patrick's sake—LET IT ALONE.'

"Most of the day gang were around. Mike's ears glowed a bright red and they wiggled a little—like they might take off in flight. He was sore enough to drown his own mother. Finally he roared, 'WADDA YA MEAN, WHAT AM I DOIN' TO THE PUMP. I JIS COME ON WATCH. I AIN'T EVEN HAD TIME TO CHANGE ME BURN-

# Valves can be operated the hard way, too...

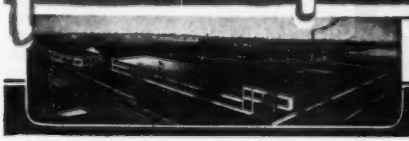
## but—

## LIMITORQUE®
## PUSH BUTTON OPERATION

...is cheaper, safer, automatic, positive and dependable

LimiTorques are available for all types of valves and may be supplied for actuation by any power source such as electricity, steam, gas, oil or air. Write for LimiTorque catalog L-50 on your business letterhead

# Philadelphia Gear Works, INC.



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*LimiTorque Valve Controls*

NICHOLSON W. O. TRAPS

**STOP COSTLY LOSS**

**OF STEAM AND AIR**

With cost of steam and compressed air steadily increasing, these 3 leak-proofing features of Nicholson weight-operated traps are proving important cost-cutters in many plants:

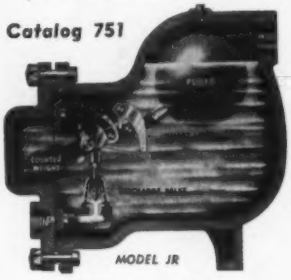
1) No air-wasting vent, such as is in all inverted bucket traps.

2) Positive water seal at valve. A Nicholson W. O. trap cannot lose prime and leak live steam.

3) Large orifice keeps valve clean, preventing blow-through.

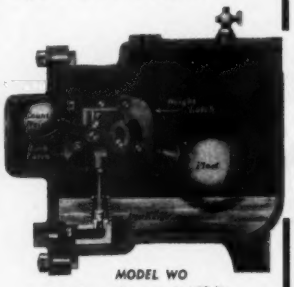
Three types, for pressures to 1500 lbs. Working parts of stainless steel.

Catalog 751



MODEL JR

for steam, air press. to 200 lbs.



MODEL WO

for steam, air press. to 650 lbs.

W. H. NICHOLSON & CO., 125 Oregon St., Wilkes-Barre, Pa.

*We have them in standard or extra gauges in all sizes. Accurately fabricated to any specification.*

**BOILER TUBE CO. OF AMERICA**

McKEES ROCKS, PA. (Pittsburgh District)

PITTSBURGH
CHICAGO

FRED S. RENAULD & CO.
LOS ANGELES

## MARMADUKE

Continued from page 210

ERS YET. AND WHAT HAPPENS? —I know Surfaceblow is doin' somethin' —but jis let me ketch him,' he grunts.

"'Look here, Mike,' I told him in the messroom that evening. 'You've been trying to foul me up with your clumsy tricks ever since I came aboard. But you're only fooling yourself. Why don't you pack your bag and start all over on some other ship and play the game right."

"'No overgrown gorilla's runnin' me off this ship', yelled Mike, stubbornly.

"But for the next three days Mike had trouble. He'd come on watch and BINGO—the pump would stop. It got so the boys were making bets on the exact time.

"By the time we hit San Pedro, Mike had enough. He packed his seabag and left the *Heliopolis* soon as we tied up."

Marmaduke paused, looked around the hall. "What did I do to make that pump run on my watch?" he asked, with a smug look on his pan.

"After she stalled twice on me, I checked her steam end. I found a half-inch valve in its steam line on the electric-generator platform above. This valve was hooked to atmosphere.

"I screwed a 4-inch-long nipple vertically into it, with another valve on its end. Then I filled the nipple with rod-swabbing cylinder oil. By closing the top valve and cracking the bottom one, that oil fed gradually into the steam cylinder during my watch. Before going off watch I unscrewed that rig and hid it.

"I knew that oil wasn't used on steam ends aboard ship and that it wouldn't help the boilers, but it would keep the pump running until she was repaired. To be on the safe side, I gave the boilers a surfaceblow once each watch."

Marmaduke paused again. "To beat people like Mike at their own game, you gotta be smarter than they are," he roared. "That's one piece of unfinished business I finished—for good."

## WITH OUR READERS

Continued from page 5

to wonder how many 50-year subscribers we have. How about letting us hear from you, old-timers?

And that led us to another thought. We thoroughly enjoy visits from POWER readers. We like the chance to put our feet up and talk about your problems and ours. And we like the opportunity to show you around the McGraw-Hill Building, give you a look behind the scenes of a top-flight publishing operation.

Next time you're in New York, come in to see us. The welcome mat is down and the latchstring is out.—*Ed.*

# *All These Were Once*

# DUST COLLECTION PROBLEMS, TOO

*48 Carbon Black Plants*

*203 Metallurgical Installations*

*205 Acid Plants*

*40 Paper Mills*

*270 Detarring Installations*

*216 Power Stations*

*73 Steel Plants*

*99 Oil Refineries and Miscellaneous Installations*

Your electrical precipitator installation will be individually engineered...and based on the Research Corporation's *experience* graphically shown by that towering pile of thousands of blue prints.

This knowledge is a valuable asset that will help Research engineers to "tailor-make" your Cottrell installation. For example, they can more quickly determine the right answers to such variables as the size, shape and type of both discharge and collecting electrodes, their relative spacing, flue arrangements and many other factors. At Research you can count on *profitable solutions to individual problems.*

In hundreds of power plants today, Research Corporation Cottrells are collecting 90% to over 99% of fly ash from pulverized fuel boilers. Write for your free copy of an informative booklet giving valuable data on these installations.

RC-110

## *Typical One Day Collections:*

250 TONS OF FLY ASH • 6 TONS OF SODA SALTS AT A PAPER MILL • 25 TONS OF SODIUM SULPHATE AT A KRAFT MILL • 6 TONS OF BLAST FURNACE DUST

**RESEARCH CORPORATION**

*405 Lexington Avenue, New York 17, N. Y.*
*122 South Michigan Avenue, Chicago 3, Illinois*

# STEAM REDUCING VALVES

# ATLAS

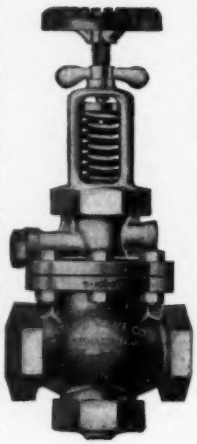
TRADE MARK REG. **Type "B" valves are now**

# STELLITED

At the right we show ATLAS TYPE "B," always a remarkable performer, and now a *much better* performer because it is STELLITED. The Pilot Valve is made entirely of that famous metal. The seat is STELLITE faced.

Try a Type "B" and you will find that it is unequaled for a service that demands tight seating and uniform reduced pressure. With this STELLITED valve wide fluctuations in initial pressure have practically no effect on the reduced pressure because of the pilot operation. Renewable piston chamber, internal pilot valve and main valve strainers. Main valve disc seats tight because disc is guided by center bearing cast integral with seat ring. Control diaphragm and controlled pressure port are integral with the valve body. The main valve is caused to open wide and close tight with slight changes in the reduced pressure through the operation of the pilot.

In addition, Type "B" is simple to maintain. Main valve disc and pilot valve are easily removed for cleaning or regrinding. The entire pilot valve can be lifted out by merely removing diaphragm and unscrewing pilot valve seat.



**CHECK THESE ATLAS PRODUCTS**

*Check the ATLAS Products below on which you want complete data. Mail to us with your name, firm name, and address.*

- ☐ Type "B" Reducing Valve
- ☐ Other Reducing Valves
- ☐ Damper Regulators
- ☐ Temperature Regulators
- ☐ Exhaust Control Systems
- ☐ CAMPBELL Boiler Feed Water Regulators
- ☐ Pump Governors
- ☐ Pressure Regulators
- ☐ Oil Control Cocks
- ☐ Humidity Controllers
- ☐ Thermostats
- ☐ Balanced Valves
- ☐ Control Valves

**Type "B" for 250 lb. Service.** Iron Body—Flanged Ends—Bronze or Nickel Alloy Seats and Valves—Pilot Operated. For initial working pressures from 20 to 250 lb. saturated steam: for reduced working pressures from 1 lb. to within 20 lb. of initial pressure in one stage. Sizes: 2½", 3", 4", 5", 6", 8".

**Type "B" for 300 lb. Service.** All bronze—Screwed or Flanged Ends—Bronze or Nickel Alloy Seats and Valves—Pilot Operated. For initial working pressures from 25 to 300 lb. saturated steam: for reduced working pressure from 1 lb. to within 20 lb. of initial pressure in one stage. Sizes ½", ¾", 1", 1¼", 1½", 2".

**Type "B" for 400 and 600 lb. Service with Temperature up to 900° F.**—Steel body. Monel Metal. Stainless Steel and Nitralloy Seats—Stainless Steel Piston and Piston Chamber—Flanged Ends—Pilot Operated. For reduced working pressures from 1 lb. to within 30 lb. of initial pressure in one stage. Designed and built to withstand severe corrosion and wearing service under high pressure and temperature conditions. Sizes ½", ¾", 1", 1¼", 1½", 2", 3", 4", 6". Series 40 for steam service to 400 lb. Series 60 for steam service to 600 lb.

**ATLAS VALVE COMPANY**

REGULATING VALVES FOR EVERY SERVICE

**Specialists in Regulation for More Than a Half Century**

**289 SOUTH ST., NEWARK 5, N. J.**

*Represented in Principal Cities*


## More POWER NEWS

*Continued from page 152*

Hickory plant, now under construction on the Cumberland River in Tennessee.

Three other plants have been built on this river system: Wolf Creek with 377,000-hp capacity and 214-to-111-ft head is scheduled for operation by the end of this year. Center Hill with an installed capacity of 189,525 hp and a 206-to-134-ft head is also scheduled for operation by the end of this year. A third plant, Dale Hollow, went into operation in 1948 with two 25,000-hp units. A third unit is now being installed, which will bring plant capacity to 75,000 hp, under a head of 154-118 ft.

Wolf Creek plant is directly on the Cumberland River with Center Hill on Carney Fork and Dale Hollow on the Obey River, tributaries of the Cumberland. Old Hickory is being built on the main river and is the fourth of 16 projects that the U.S. Corps of Engineers has planned for complete development of the river. This will include over 1,100,000-hp of power capacity.

Consideration by the Commission of additional proposals will be postponed for the time being, since it is felt that four study projects is the maximum that can be carried on simultaneously in view of the demands that will be placed on technical personnel of the AEC and its laboratories and contractors. The two laboratories principally concerned are the Argonne National Laboratory at Chicago and the Oak Ridge National Laboratory at Oak Ridge, Tenn., both of which have heavy development programs of high importance to the national defense.

## COMING EVENTS

**Aug 20-23—American Institute of Electrical Engineers,** Multnomah Hotel, Portland, Ore. R S Gardner, assistant to secy, AIEE, 29 W 39th St, New York 18, N. Y.

**Sept 10-14—Sixth National Instrument Conference and Exhibit,** Instrument Society of America, Sam Houston Coliseum, Houston, Texas. ISA, 921 Ridge Ave, Pittsburgh 12, Pa.

**Sept 25-28—American Society of Mechanical Engineers,** fall meeting, Radisson Hotel, Minneapolis, Minn. O B Schier, chairman, ASME, 29 W 39th St, New York 18, N. Y.

**Nov 5-8 — All-Industry Refrigeration and Air Conditioning Exposition,** Navy Pier, Chicago, Ill. George E Mills, show director, 1346 Connecticut Ave, N W, Washington 6, D. C.

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Fred J Koster, chief engineer of Roosevelt Hospital, Manhattan, has been awarded by the **National Assn of Power Engineers,** New York Chapter No. 1, the "Dr Robert Grimshaw Medal" for outstanding engineering ability. The presentation has been made by Harry A Waite, supervising engineer of the Hotel Astor at the chapter headquarters, Masonic Temple, 220 E. 15th St, New York City.

# EXPLOSION PROOF!

## UNDERWRITERS' APPROVED FOR HAZARDOUS LOCATIONS

Approximately ½ Actual Size

**SERVICE RANGE—**

**Maximum body pressure, 40 lbs.**
**Body tapped for 1" pipe top and bottom.**
**Shipping weight, 25 pounds.**

**ELECTRICAL RATINGS—**

**A.C.—½ hp. 115 or 230 Volts**
**A.C.—25 Amps. 115 Volts; 12½ Amps. 230 Volts (Non-Inductive Load)**

**Pilot Duty Service:**

**A.C.—125 Volt-Amps. 115 or 230 Volts**
**D.C.—57½ Volt-Amps. 115 or 230 Volts**

Here is a complete float-operated electric controller that can be used under conditions where a conventional controller could not be used. It is the McDonnell No. 65 explosion-proof float controller, for water tanks, receivers and other liquid storage systems.

This dependable float controller can be used to "make" or to "break" electrical circuits at either high or low liquid levels — for example, controlling motors, signal lamps, electrical elements, etc. It has been Underwriters' Laboratories, Inc. tested and approved for use under the following hazardous conditions:

*Class 1, Group C—Atmospheres containing ethyl-ether vapors, ethylene, or cyclopropane.*

*Class 1, Group D—Atmospheres containing gasoline, petroleum, naphtha, benzine, butane, propane, alcohols, acetone, benzol, lacquer solvent vapors, or natural gas.*

*Class 2, Group F—Atmospheres containing carbon black, coal or coke dust.*

*Class 2, Group G—Atmospheres containing flour, starch or grain dusts.*

Naturally, to receive this approval, the No. 65 is built to highest standards incorporating McDonnell packless construction, heavy-duty mercury switch and totally enclosed wiring and terminals. Standard switch furnished breaks circuit with falling liquid level, but reverse acting switch, completing circuit with falling liquid level, is also available. Float chamber is heavy cast iron; float is copper; float rod, brass; bellows, bronze. Service range and electrical ratings are shown opposite.

A consideration of the operating characteristics, pressure range and materials will suggest many important uses for this float operated electric controller. Ask for circular and service recommendation covering your particular conditions.

**McDONNELL & MILLER, INC., 3500 N. Spaulding Ave., Chicago 18, Ill.**

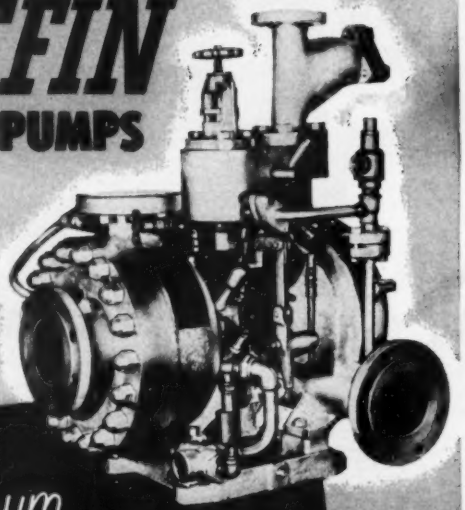
*Doing One Thing Well*

**McDONNELL** *Boiler Water Level Controls*

Specify high speed, single stage

COFFIN TURBO PUMPS

MATCHED PUMP, TURBINE AND GOVERNORS IN ONE COMPACT LIGHTWEIGHT ASSEMBLY



– for minimum steam consumption

The Coffin high efficiency pump combined with a high speed two bucket row turbine result in minimum steam consumption on even the toughest pumping operations. For example, Coffin single stage pumps at 7200 RPM are the approximate equivalent of 3 to 6 stage pumps at 3600 RPM. Coffin 12 inch turbine bucket wheels at 7200 RPM are equal to 24 inch turbine bucket wheels at 3600 RPM. Superb Coffin engineering includes many other maintenance-saving features. Get all the facts on Coffin designed Turbo Pumps, now!

STANDARDIZED PARTS REDUCE LOSS OF TIME

All Coffin models are assembled to specification from standardized stock parts. Fast service from regular stocks of any wearing part is available at all times. For immediate shipment of guaranteed rebuilts, check on the time-saving Coffin Exchange Plan!

Ask for free DATA FOLDER

Contains complete specifications and operational data on Coffin Turbo Pumps for marine and general service. Call or write today, for your copy.

THE J.S.COFFIN, Jr. COMPANY

324 SOUTH DEAN STREET
ENGLEWOOD, NEW JERSEY

REPRESENTATIVES IN ALL PRINCIPAL CITIES


## APPOINTMENTS

**Riley Stoker Corp** announces establishment of a direct factory branch office at 504 Pan American Bldg, Camp and Poydras Sts, New Orleans, La. T C Beatty, district manager, will be in charge.

Houston office of **Leeds & Northrup Co** has been moved to 2480 Time Blvd, Houston, Texas.

**General Electric Co** reports the following personnel changes: Alan Howard is appointed operation manager for gas turbine div. J P Keller becomes assistant operation manager. . . . Richard S Walsh is now manager of induction motor sales div of Small and Medium Motor Divisions at Schenectady, N. Y. . . . John T Holleran is named manager of the Fort Edward, and Hudson Falls operations of Transformer and Allied Product Divisions at Fort Edward, N. Y. . . . Harold R. Berkal assumes duties as wire and cable specialist for Construction Materials central district. He will serve the Omaha trading area with offices at 438 Electric Bldg in this city. . . . G H Campbell succeeds A W Lunn who retires as manager of the company's Newark, N. J. office. . . . Raymond C Freeman is named manager of Welding Divisions at Fitchburg, Mass. Alanson U Welch succeeds him as manager of engineering of the same divisions.

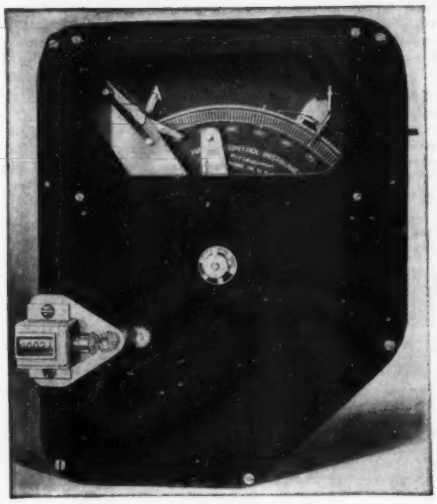
**GE** also announces the following new welding distributors: Serving New York State from Poughkeepsie west to Geneva is Welding Engrg & Equip Co, Syracuse, N. Y. Eastern and Northern New Jersey, the metropolitan area of New York and Long Island, and New York State north as far as Poughkeepsie is being handled by Welding Sales Corp, with offices at Newark, N. J. Welding Equip Sales Co of Buffalo will cover New York State west of Geneva. The above distributors take over sales and services formerly offered by Welding Engrg Sales Corp of New York City. Alabama Oxygen Co is chosen to handle the Birmingham area. Odland Iron Works will serve the Toledo, Ohio area.

Executive changes in the Boston Works of **Allis-Chalmers Mfg Co** have been made as follows: Leonard J Linde has become assistant general manager and chief engineer; Henry P Pinkham, assistant chief engineer; John F Chipman, product engineer; George W O'Keeffe, manager of sales; Alfred E Kilgour, assistant manager of sales; Russell J Neagle, special representative; and Chester D Ainsworth, standards engineer.

**Timken Roller Bearing Co,** Canton, Ohio, reports the promotion of H J Urbach to executive engineer; C M Maratta, chief consulting engineer; L A Holder, chief mechanical engineer; and R A Schimpf, chief works engineer.

New distributors and their assigned territories for **Nordberg Mfg Co** are: Houston Engine & Pump Co, 1939 St. Bernard St, Houston, Texas (Gulf Coast of Texas and territory within a 100 mile radius of Houston); O'Keefe Motors Inc, 403-15 Samuel

# Accurate integration over the entire range in HAGAN



## RING BALANCE METERS

This wide range accuracy is due to the unique design and precision construction of the Hagan integrator.

In this integrator, a large toothed wheel is set in motion periodically. The movement at each interval is governed by the flow index pen and is proportional to the momentary rate of flow. The wheel is geared to a counter which registers the total flow through any period, by difference in the counter readings.

The Hagan integrator differs fundamentally from others in that all associated parts rotate around a common center. As a result, angularity errors are eliminated and only one simple adjustment is required for calibration throughout the range. The large six inch integrating wheel produces the required selectivity to integrate as low as two percent (of chart) with high accuracy. With this construction, wear between toothed wheel and the pawls is eliminated. There are no clutches to wear and slip.

The instantaneous pawl action also produces high accuracy under rapidly fluctuating flow conditions.

The graduations on the large wheel and pointer facilitate checking the calibration of the integrator at any point in the range in one minute or less.

The Hagan Integrator is a self-contained unit and may be mounted conveniently in any of the various types of Ring Balance flow meters, or pneumatic receivers.

For full information on this and other features of Hagan Ring Balance meters, write to Hagan Corporation, Hagan Building, Pittsburgh 30, Penna.

HAGAN HALL BUROMIN CALGON

**HAGAN CORPORATION**

RING BALANCE FLOW AND PRESSURE INSTRUMENTS
THRUSTORQ FORCE MEASURING DEVICES
BOILER COMBUSTION CONTROL SYSTEMS
METALLURGICAL FURNACE CONTROL SYSTEMS

# GOOD TEMPERATURE REGULATION MEANS FEWER HEADACHES

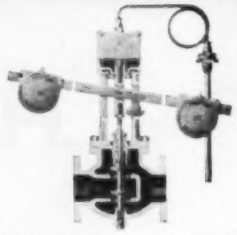
In Power Plants all over the world, you will find Foster Temperature Regulators controlling temperatures of liquids and gases on heating and cooling equipment such as fuel-oil heaters; storage type water heaters, evaporators and cooling systems. The reason for this acceptance is that they offer a simple, dependable answer to accurate, automatic temperature control. They do their job well, with a minimum of maintenance.

The Foster line of Temperature Regulators is also good news for plants where ovens, dryers, cookers, coolers, pasteurizers and similar types of equipment are extensively used. By controlling temperatures accurately, they help the uniformity of materials in process and often save fuel. They can be furnished with casing wells so that thermal units can be replaced without lowering liquid level of vessel.

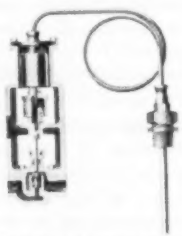
Foster Engineers are competent to work with you to get the right type of regulator for your own specific needs.

Here are 4 typical Temperature Regulators in the Foster Line of more than 8 standard types.

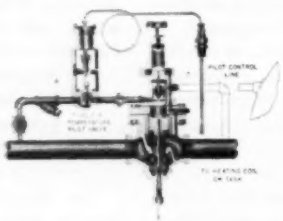
**The Foster Type 34-T** controls temperatures within approximately 1° F plus or minus, using steam or gases as heating medium, internally pilot-operated, diaphragm actuated; valve travels from shut-off to full opening with relatively small temperature change.



**The Foster Type T-3** controls temperatures within 3° to 5° F, plus or minus, using steam, water or other liquids and gases as heating or cooling medium. Handles large volumes with low pressure drop across double seats.



**The Foster Type T-4** controls temperatures within plus or minus 5° F, using small volumes of steam, water or other liquids or gases as heating or cooling medium. Direct-acting, single seated for tight shut-off.



**The Foster Type T-10** combination temperature and pressure regulator permits safe use of steam at pressures considerably higher than the shell of the heated vessel is built to withstand. Adjustable for both temperature and pressure.

## FOSTER ENGINEERING

PRESSURE REGULATORS . . . RELIEF AND BACK PRESSURE VALVES . . . CUSHION CHECK VALVES . . . ALTITUDE VALVES . . . FAN ENGINE REGULATORS . . . PUMP GOVERNORS . . . TEMPERATURE REGULATORS . . . FLOAT AND LEVER BALANCED VALVES . . . NON-RETURN VALVES . . . VACUUM REGULATORS OR BREAKERS . . . STRAINERS . . . SIRENS . . . SAFETY VALVES . . . FLOW TUBES


# More APPOINTMENTS

Begins on page 216

St, Trenton, N. J. (northern half of New Jersey); Midwest Utilities Power Equip Corp, 1270 Augusta Blvd, Chicago (northeastern Illinois, Indiana and western Michigan).

**Bigelow-Liptak Corp** has chosen Otto von Perbandt as its representative in southern Ohio, part of Indiana and all of Kentucky. He will work out of his office at 305 Schwartz Bldg, Cincinnati, Ohio.

L E Menns is now Pacific Coast sales manager for **Bridgeport Brass Co.** He will be in charge of the firm's San Francisco district office as well as the Los Angeles office.

**Cleaver-Brooks Co** has appointed Keatts Thermal Equip Co, 3851 N High St, Columbus, Ohio, as its manufacturers' representative, handling a territory comprising 36 Ohio counties.

Executive personnel changes are announced by **Philip Carey Mfg Co,** Cincinnati, Ohio, as follows: W L Steffens, sales manager—insulation div, will retire Jan 1, 1952. J C Rector will be Steffens' successor. Succeeding Rector, as Cincinnati district manager, is W H Skinner. J O McFalls is nominated to become assistant district manager following Skinner's appointment.

**Dravo Corp,** Pittsburgh, Pa., names Erwin S Mason Jr sales engineer for its Machinery Div in the Cincinnati, Ohio territory. Mason, whose office is in the Southern Ohio Bank Bldg, Cincinnati, will handle the sales of Dravo heaters and also products of the DeLaval Steam Turbine Co, C H Wheeler Div of Hamilton Thomas Co, Fuller Co and Walker Process Equip Inc.

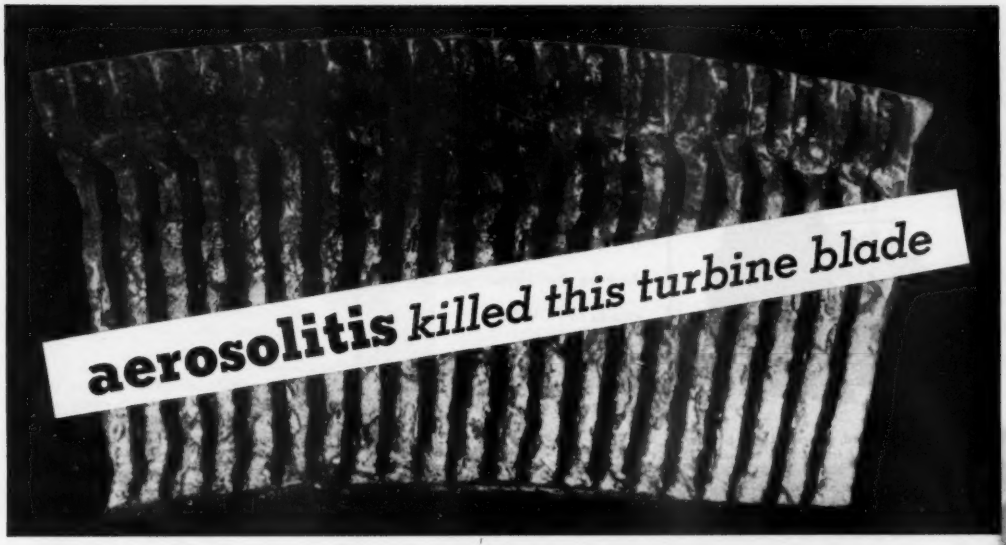
Carl W Nedderman has been promoted to vice-president of **Edward Valves Inc,** East Chicago, Ind.

William A Buckman joins **Pabco Products Inc** as assistant to H J Lilleston, vice-president in charge of marketing.

Herb Walther Jr, development engineer for **Dowell Inc** in Tulsa, has been placed in charge of the sales of cathodic protection products for retarding electrolytic corrosion of pipe lines and industrial equipment. . . . William E Bunting has been named development engineer in Chicago. . . . Richard W Stetson has become Dowell's cathodic protection representative in New York City.

**Manning, Maxwell & Moore Inc** appoints Edwin H Price Pacific Coast district manager to succeed Newton P Selover who is now director of export planning. Price's headquarters will be in Los Angeles, Calif.

**Westinghouse Electric Corp** announces the following appointments: H B Kiphuth is named assistant director of management development. . . . T C Finnell succeeds T R Lawson as assistant manager for application engineering dept of Motor and Control Div, Buffalo, N. Y. Lawson is transferred to the firm's headquarters in Pitts-




## *Dearborn polyamide anti-foams prevent this*

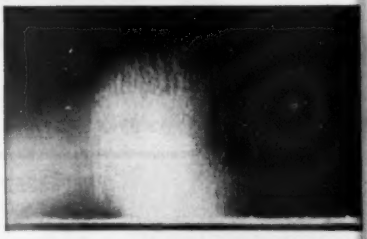
# deadly boiler disease

Here is an unretouched photo of a turbine blade that was *killed by aerosolitis.* Replacement was, of course, both necessary and expensive.

But *aerosolitis*—more prevalent with some waters than with others—can be easily and inexpensively prevented with Dearborn Improved Polyamide Anti-Foams. In addition to inhibiting the formation of harmful *aerosols,* Dearborn Polyamide Anti-Foams prevent foaming to produce purer steam—eliminate scale formations—condition sludge—are compatible with other treatment.

IF YOU USE STEAM for power or process, investigate the time-, money-, and labor-saving advantages of Dearborn Polyamide Anti-Foams and the complete Dearborn Industrial Water Treatment and Engineering Service. A Dearborn engineer is at your service. The coupon is for your convenience.

**DEARBORN CHEMICAL COMPANY**
**Merchandise Mart Plaza • Chicago 54, Illinois**



**AEROSOLITIS AT WORK**

**Aerosols are tiny drops of water dispersed in the steam which cause encrustation on superheaters, foul turbine blades. When this happens, boilers have *aerosolitis,* and costly shutdowns and repairs will result.**

Dearborn Chemical Company, Dept. PO
Merchandise Mart Plaza
Chicago 54, Ill.

Gentlemen: Please send:

- ☐ Bulletin on Dearborn Improved Polyamide Anti-Foams
- ☐ Bulletin on Dearborn Industrial Water Treatment and Engineering Service
- ☐ Have a Dearborn Engineer call

*Name*.....

*Company*.....

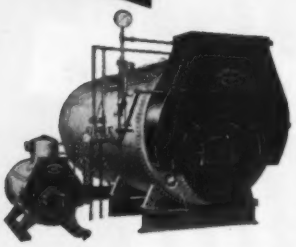
*Position*.....

*Address*.....

*City*.....*State*.....

Dearborn
TRADE MARK REGISTERED
THE LEADER IN WATER TREATMENT AND RUST PREVENTIVES

A BOILER With Economy
A LEFFEL Scotch Boiler!



Users of self-contained, compact Leffel boilers report fuel savings of from 20 to 40 percent over other types. The 17 sizes are available in ratings of from 6 to 250 *actual* horsepower. And the sturdy, dependable construction of all Leffel boilers permits substantial overloading with safety. Designed to burn COAL, GAS, or OIL, they are easily converted from one fuel to another. There is an efficient Leffel Scotch type boiler, easy to install, ready to go to work in your plant . . . today!

Write for descriptive catalog

The James Leffel & Co.
established 1862
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please be sure to let us know promptly. It takes time to correct the stencil addressing plate. And we don't want you to miss copies of POWER.

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(1) your OLD address
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POWER

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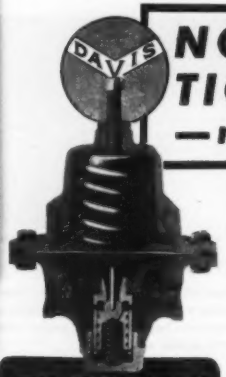



NON-STICKING!
TIGHT CLOSING!
—no pressure build-up

DAVIS NO. 13 AUTOMATIC PRESSURE REDUCING VALVES

**PREFERRED BY USERS—**
Users report excellent results in maintaining reduced pressure on radiators, vulcanizers, steam tables, steam jackets, and similar equipment.

**EXCLUSIVE DESIGN—**
Single seated, tight closing, non-sticking. Large diaphragm, sensitive pressure adjustment. Compact, rugged, self-contained.

**TROUBLE-FREE SERVICE—**
Built-in strainer, finest quality, all internal parts accessible and renewable without disturbing piping.

**FOR STEAM, AIR OR GAS—**
For initial pressures to 250 p.s.i.; reduced pressures, 1 to 100 p.s.i. Sizes from 3/8" to 2". Semi-steel bodies; bronze or stainless trim. Economical for use on small units.
*Write for literature.*

DAVIS REGULATOR CO.
*Established 1875*
2540 SO. WASHTENAW AVE. CHICAGO 8, ILL.

## More APPOINTMENTS

Begins on page 216

burgh. . . . S C Palmer replaces J A Schoch as manager of transportation sales dept. Schoch is now consulting engineer for Transportation and Generator Div. . . . Edward W Marek takes over William H Bingham's duties as eastern district apparatus and supply sales manager. Bingham is the new Eastern district manager of Westinghouse Electric Supply Co with headquarters in Long Island City, N. Y. He succeeds Roy L Brown who resigned to become executive vice-president and general manager of the new Canadian Westinghouse Supply Co.

Process Industries Engineers Inc, Pittsburgh representative for **Warren Steam Pump Co,** has opened an office at 703 Temple Bldg, Rochester, N. Y., and will represent Warren in up-state New York. J L Woll will be in charge.

L M Evans has been put in charge of the new Rochester, N. Y. branch office of **Worthington Pump & Machy Corp.** The office is at 1246 Sibley Tower Bldg.

Arch J Cochrane has been made assistant manager of Chicago district operations for **Youngstown Sheet & Tube Co.**

The New England office of **Acheson Colloids Corp** is now located at 89 Broad St, Boston, Mass.

**Air Reduction Co, Inc,** New York City, elects S D Baumer vice-president of Airco Equip Mfg Div. . . . Edward H Roper becomes manager of Airco general technical sales dept.

Anthony J Zino Jr assumes position of domestic general sales manager of **Joseph Dixon Crucible Co** with headquarters in Jersey City, N. J.

**Chain Belt Co** reports the appointment of the following district sales engineers: Edward D Williams is assigned to Philadelphia district sales office; Truman J Hammel, Kansas City office; R W DeMott Jr, New York; Kenneth Burch, Cleveland; and George Robichaud, Boston.

T O Kuivinen, R F Kymer and W R Crooks have been made chief engineer's assistants in **Cooper-Bessemer's** engineering organization. E C Phelps has been elevated to assistant works manager. Harold Johnson has become factory superintendent and I W Ferguson, manager, quality control.

**Dampney Co,** Boston, announces promotion of Lachlan W Maclean to vice-president in charge of manufacturing and engineering. John D MacDougall is appointed to sales office staff. . . . The following are chosen as distributors: W C Christensen, 129 Texas Ave, Jackson, Miss., is assigned the territory in southern Mississippi and northeastern Louisiana; Marshall, Meil & Pauley Inc, 811 York St, Houston, will cover southeastern Texas; and Marine Specialty Co, 6 S Water St, Mobile, Ala., will

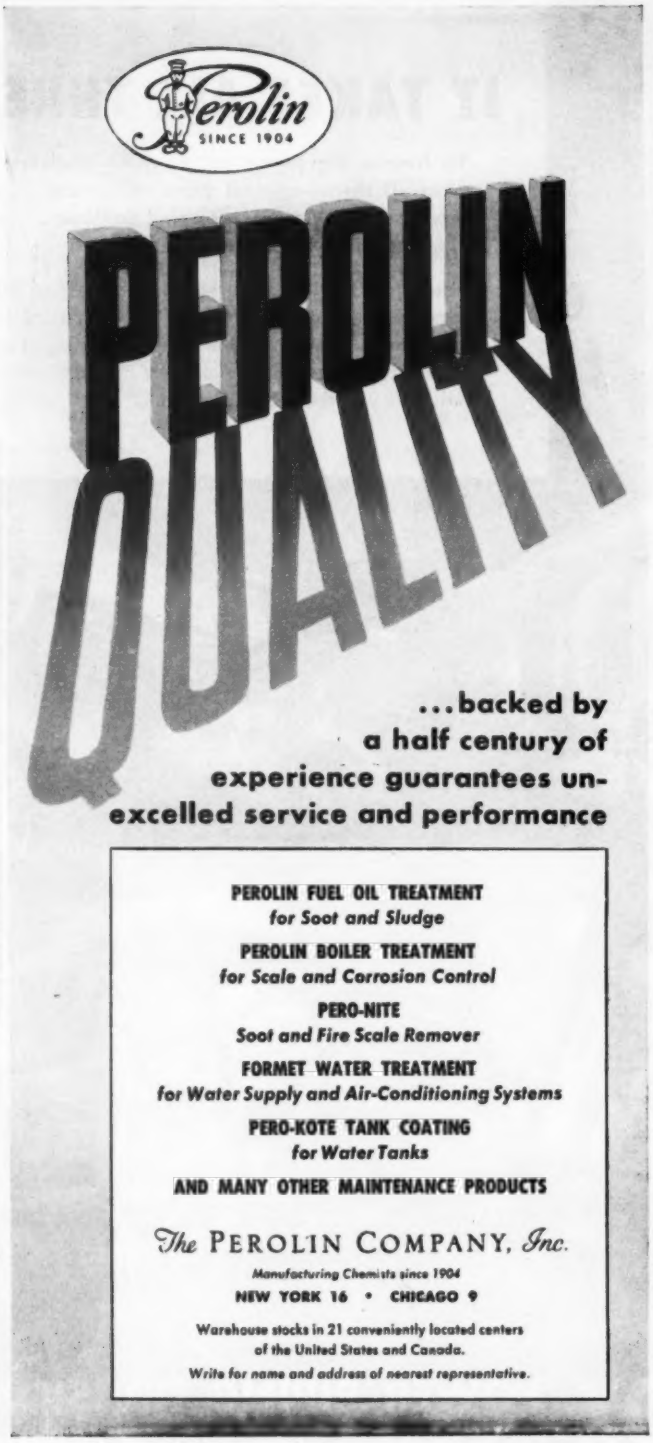
# IT TAKES ALL THREE!

To handle big power piping jobs efficiently it takes all three—unusual plant equipment . . . exceptional field organization and facilities . . . and top-notch heavy piping experience.

When plans call for extreme pressures and high temperatures, when space limitations complicate installation, when special alloys or complicated fabrications must be used, Power Piping Division will give you the job you want!

**BLAW-KNOX** POWER PIPING DIVISION
OF BLAW-KNOX CONSTRUCTION COMPANY

1525 Pennsylvania Avenue, Pittsburgh 33, Pa.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...backed by a half century of experience guarantees unexcelled service and performance
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AND MANY OTHER MAINTENANCE PRODUCTS
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Manufacturing Chemists since 1904
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Warehouse stocks in 21 conveniently located centers of the United States and Canada.
Write for name and address of nearest representative.

## More APPOINTMENTS

Begins on page 216

add industrial representation in Mississippi, Alabama and Florida, in addition to its present marine coverage of the Port of Mobile.

Neil J Braski assumes duties as plant engineer of **Diamond Alkali Co's** Painesville, Ohio plant. Jack R Horacek succeeds him as power department superintendent.

**Falk Corp** names Richard A Keling manager of its new sales office in Newark, N. J. This office will serve the counties of Bergen, Union, Hudson, Essex, Middlesex, Somerset, Morris, Passaic, Sussex, Hunterdon, Monmouth, Mercer and Warren.

John C Wallace, formerly with Baldwin-Lima Hamilton Corp, has joined **Hunt-Spiller Mfg Corp,** Boston, as chief engineer for the newly created diesel engine parts research and development div.

Raoul L Larue succeeds Frank L Munsey as factory manager of the Sandusky, Ohio plant of New Departure Div, **General Motors Corp.** Munsey is now assistant plant manager.

**Hilliard Corp** selects Guy T Martin & Co, 642 E Olive St, Gardena, Calif., as its representative in this state.

Arthur B Morse is assigned by **Mexico Refractories Co** as district manager in charge of its northern California office at 2040 Fourth St, Berkeley, Calif.

**Standard Transformer Co,** has selected Carl A Froebel Co as its representative for eastern Missouri and southern Illinois.

Lloyd F Giegel replaces R Magnetti as branch manager of the Gary, Ind., sales office of **Reliance Electric & Engrg Co.** Magnetti resigned to enter the electrical construction industry. . . . Daniel J Donnelly joins the Philadelphia office as sales engineer.

**Wheelco Instruments Co** announces the opening of a district agency, Engineering Products Co, P O Box 1107, Charleston, W. Va., for this state. The office will be under the direction of F E Anderson.

## OBITUARIES

**Cecil E Bales,** president of Ironton Fire Brick Co, Ironton, Ohio, died May 26.

**John M Hopwood,** 67, chairman of the board of Hagan Corp and its subsidiaries, died June 8 after a lengthy illness in Vero Beach, Fla.

**Dr Edward L Moreland,** 65, for the past 35 years a partner in the engineering firm of Jackson & Moreland, Boston, died suddenly on June 17 in West Falmouth, Mass.

**Frank S Schuyler,** 66, retired manager of Allis-Chalmers Detroit district office, died June 10 following a brief illness.

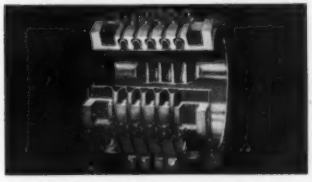
# Zallea Expansion Joint News

PUBLISHED BY ZALLEA BROTHERS—WORLD'S LARGEST MANUFACTURERS OF EXPANSION JOINTS

## Expansion Joint of the Month

### DUO EQUALIZING TYPE

The ideal corrugated expansion joint is one in which all corrugations move simultaneously during expansion or contraction of the piping, and no corrugation can be compressed or extended more than the proportionate amount for which it is designed. This briefly describes the Zallea Duo Equalizing Expansion Joint, so called because it functions in two ways: equalizing the compression among the corrugations simultaneously when the pipe line is expanding and likewise distributing the elongation simultaneously and proportionately among all the corrugations when the line is contracting.



This is accomplished by the simple expedient of a pantograph. Two or more pantographic chains are superimposed on the equalizing rings of the expansion joint, the neutral points being anchored in the end fittings and intermediate equalizing rings. Any movement of the end fitting is immediately and simultaneously transmitted to all equalizing rings. In this manner all the equalizing rings move the same relative distance at the same time. This Zallea Joint is recommended for all intermittent steam services in long lines, institutions, and industrial plants.

. . . a brand new 4-page folder on *all* Zallea Expansion Joints. Send for your copy of Bulletin 351 today!

ZALLEA BROTHERS, 814 Locust Street, Wilmington 99, Delaware.

## WORDS YOU DON'T EXPECT:

## *"Guaranteed Delivery"*

Restrictions . . . allotments . . . priorities . . . material shortages . . . backorders . . . uncertainty . . .

Take your choice . . . these are familiar words to industrial buyers today.

Not too often, however, does the industrial buyer hear those seemingly long-lost words, "Guaranteed Delivery".

This is especially true about stainless steel expansion joints.

You've all heard the well-worn "we'll-take-your-order" routine. But delivery date? That's something else again!

Like many an industrial faced with expansion problems, you know all-too-well that you can't afford to risk shutdowns today because of unsatisfactory or inadequate expansion joint performance. Production *must* be kept moving at the required fast pace.

Here's the unexpected!

We are in a position to fill your standard expansion joint needs . . . promptly! (6 weeks on large orders, 4 weeks on medium orders and *2 to 3 days on emergency orders, if necessary.*)

The reason isn't too unusual. As the world's largest manufacturers of expansion joints, we maintain, at all times, a complete stock of component parts. Many months ago, we here at Zallea Brothers anticipated today's critical material situation, and did something about it. Today, we have an adequate supply of stainless steel *on hand*. We do not have to wait for mill deliveries.

We realize, however, that our stocks won't last forever . . . far from it. But so long as we can keep turning out *quality* expansion joints that will give you the lasting performance you want, you are assured of *guaranteed delivery* on all Zallea standard units.

Sol Zallea

*(Advertisement)*

KEWANEE
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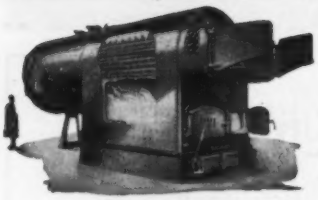

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Has all the characteristics which make firebox boilers ideal for high pressure. Complies fully with ASME and SBI codes.

Outstanding for extra years of dependable service in producing hi-pressure steam economically with Oil, Gas or Coal.

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# More FREE BULLETINS

Begins on page 167

requiring remote or automatic control. 1-page data sheet No. 4B. Metron Instrument Co, 432 Lincoln St, Denver 9, Colo.

**B27 POWER TRANSMISSION DRIVES**—Information on Hy-Vo power transmission drives including operating principles, highlights of new design principles, capacities, speed ranges, service factors for selecting drives, installation and lubrication procedures. Catalog No. C 72-51. Morse Chain Co, 7601 Central Ave, Detroit 8, Mich.

## METERS AND INSTRUMENTS, ELECTRIC

**B28 POTENTIOMETER CONTROLLER**—Gives engineering specifications of the new Brown ElectroniK strip chart pneumatic control potentiometer. 2-page specification sheet No. 175. Minneapolis-Honeywell Regulator Co, Brown Instruments Div, Wayne & Windrim Aves, Philadelphia 44, Pa.

**B29 STRIP CHART RECORDER**—Describes the Brown ElectroniK strip chart recorder. Installation, system benefits, other data included. 4-page data sheet No. 9.1-7. Minneapolis-Honeywell Regulator Co, Brown Instruments Div, Wayne & Windrim Aves, Philadelphia 44, Pa.

**B30 PROCESS RECORDER** — Operation and construction features of a duplex ElectroniK recorder which simultaneously plots two totally independent variables on one chart. 2-page data sheet No. 10.0-6. Minneapolis-Honeywell Regulator Co, Brown Instruments Div, Wayne & Windrim Aves, Philadelphia 44, Pa.

**B31 PORTABLE PYROMETERS** — Features two portable pyrometer models for quick and accurate spot checking on industrial heating equipment. Specifications on thermocouple holders and tips also included. 2-page bulletin No. PPY-1 with separate price list. Wheelco Instruments Co, 847 W Harrison St, Chicago 7, Ill.

**B32 FUNCTION PLOTTER**—Gives operation and instrument characteristics and other technical information on the new ElectroniK function plotter which automatically plots one variable in terms of another. 4-page data sheet No. 10.0-5. Minneapolis-Honeywell Regulator Co, Brown Instruments Div, Wayne & Windrim Aves, Philadelphia 44, Pa.

**B33 SPLIT-CORE METER**—Describes a hook-on power-factor meter that permits direct measurement without cutting conductors or interrupting electrical service. Selection chart included. 16-page bulletin No. GEA-5469. General Electric Co, Schenectady 5, N. Y.

**B34 RECORDING INSTRUMENTS** — Covers a new line of recording voltmeters and ammeters known as the Series 500 electric recorders. Information on models, ranges, specifications and uses included. 28-page bulletin No. E1111. Bristol Co, Waterbury 20, Conn.

## METERS AND INSTRUMENTS, MECHANICAL

**B35 COMBUSTION CONTROL**—Three bulletins on automatic controls and instruments for draft control systems available. One bulletin deals with oil, a second with gas, and a third with stoker-firing. Application details and wiring diagrams included in each. Perfex Corp, Industrial Controls, 500 W Oklahoma Ave, Milwaukee 7, Wis.

**B36 CORROSIVE LIQUIDS**—Guide to the proper selection of meters for measuring more than 200 liquids with varying corrosive characteristics. Contains a simplified specification sheet, dimensions, and operating data. 12-page bulletin No. 0G400. Rockwell Mfg Co, 400 N Lexington Ave, Pittsburgh 8, Pa.

**B37 RUNNING-TIME RECORDER** — Gives information concerning the application of the new Series 500 run-

Natural Graphite puts

"MORE MUSCLE"

into grease!

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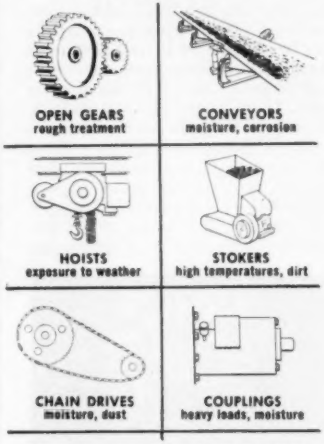


*In Fact:*—for *all* applications where conditions of dirt, dust or moisture prevail.

What are *your* tough lubricating jobs...where *ordinary* greases take a beating? Try greases fortified with Dixon *Natural* Graphite. Then see the big improvement!

Why? Because greases combined with Dixon *Natural* Graphite provide outstandingly effective lubrication *under even severest conditions* ...where dirt and dust abound; rain and moisture; high pressures; temperature extremes; shock loads.

Dixon *Natural* Graphite is practically indestructible. It withstands extremes of heat and cold. It is insoluble. Inert, it is unaffected by acids and alkalies. Processed under closest laboratory control.

***What is your toughest lubricating problem?*** **Tell us the full particulars... our technical department will analyze your problem and send you specific recommendations and a sample of the proper Dixon lubricant. No obligation. Write, Joseph Dixon Crucible Co., Jersey City 3, N. J.**

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**S-E-Co.** CONICAL Non-Segregating Coal Distributors deliver a uniform mixture of coarse and fine coal across the stoker hopper. Fuel losses and difficulties in operation of the stoker that are prevalent due to coal segregation are thereby eliminated.

Without coal segregation, combustion occurs evenly across the stoker, the average $CO_2$ is higher, and the percentage of combustible in the ash is reduced.

The stoker and arches require less maintenance and the fuel burning capacity of the stoker is increased.

Many existing plants have replaced old style flat chutes and weigh larries with CONICAL Distributors and, as a result, have obtained better stoker operation. CONICAL Distributors are indispensable for new stoker installations where designing engineers aim to build a plant giving maximum performance.

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**Reducing Valves**

Masoneilan Pressure Regulators — for steam, water or air service — reduce waste, cut costs and save money by holding pressures within the required limits without constant maintenance. That's why you find plant men in all types of industry using and recommending them for reducing service. Their experience proves that Masoneilan valves eliminate pressure reducing problems.

*No. 11* for steam service — Sizes ½" to 4". Reduced pressure ranges between 5 and 75 psi or 75 and 225 psi. Maximum working pressure 250 psi.

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## More FREE BULLETINS

Begins on page 167

ning-time recorder to presses, factory machinery, refrigerators, pumps and motors, conveyors, continuous ovens and furnaces. Well illustrated. Bulletin No. OP1504. Bristol Co, Waterbury 20, Conn.

**B38 CO2 RECORDER**—Gives information on the Hays automatic $CO_2$ recorder complete with application details, description of orsat principle of operation. Selector chart is included as a guide to mountings and various models. 4-page bulletin No. 51-583. Hays Corp, Michigan City, Ind.

**B39 LOW PRESSURE INSTRUMENTS**—Describes a line of draft and low pressure instruments such as indicators, recorders and controllers. Includes information on calibrating springs, diaphragm units, differential valve assemblies. Application table also given. 20-page bulletin No. 51-667. Hays Corp, Michigan City, Ind.

### PIPING, FITTINGS, VALVES AND SPECIALTIES

**B40 HOSE FITTINGS AND LINE OILERS**—Sizes, parts numbers and applications of Blue Brute hose fittings given in 4-page bulletin No H-1200-B44. A 2-qt line oiler is pictured and described with detailed specifications in 2-page specification sheet No. H-1200-B45. Worthington Pump & Machinery Corp, Dunellen, N. J.

**B41 STEAM SPECIALTIES** — Covers Squires steam specialties such as steam and air traps, reducing valves, pressure regulators, pump governors, temperature regulators, feedwater controls. Price list included. 40-page catalog. C E Squires Co, 18502 Syracuse Ave, Cleveland, Ohio.

**B42 STEAM TRAPS**—Detailed information on the Yarway impulse steam trap for power plants, steam distribution systems, steam processes and marine service. 24-page bulletin No. T-1740. Yarnall-Waring Co, Chestnut Hill, Philadelphia 18, Pa.

**B43 VALVE PIPING TIPS**—A useful sheet of tips on valve piping illustrates installation hints for fitters and plumbers. Sheet No. F-4774. Barber-Colman Co, Rockford, Ill.

**B44 HEAVY-DUTY COUPLING**—Describes heavy-duty wedge-lock coupling for use on temporary or permanent pipe lines. Specifications are included in range of light-weight pipe sizes from 8- to 30-in. in diameter. 4-page bulletin No. 513. Naylor Pipe Co, 1230 E 92nd St, Chicago 19, Ill.

### PUMPS

**B45 BOILER FEED PUMP**—Complete description and cross-section drawing of a high pressure barrel-type boiler feed pump. Available for pressures to 3000 psi. 12-page bulletin No. 1525. De Laval Steam Turbine Co, Trenton 2, N. J.

**B46 RECIPROCATING PUMP** — Describes recently developed 3-in. stroke direct-flow triplex pump and presents features of design, construction, dimension drawings and performance data. 6-page data sheet No. 64-A. Aldrich Pump Co, Allentown, Pa.

**B47 SELF-PRIMING PUMPS**—Shows construction of the company's new electric-motor and gasoline-engine driven self-priming centrifugal pumps for contractor's service. Specifications and ratings of different sizes and types of pumps are given. 20-page bulletin No. 51-27. Chain Belt Co, 1600 W Bruce St, Milwaukee 4, Wis.

**B48 VERTICAL SUMP PUMPS** — Details of construction, selection tables and other data on vertical sump pumps, float switches, motor starters and turbine sump pumps. 8-page bulletin No. 4600-A. Deming Pump Co, Salem, Ohio.

**B49 HIGH-PRESSURE PUMP** — Describes new design of a high-

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Just another modern High Pressure-High Temperature Power Plant in the Southwest that has DEPENDABLE Piping.
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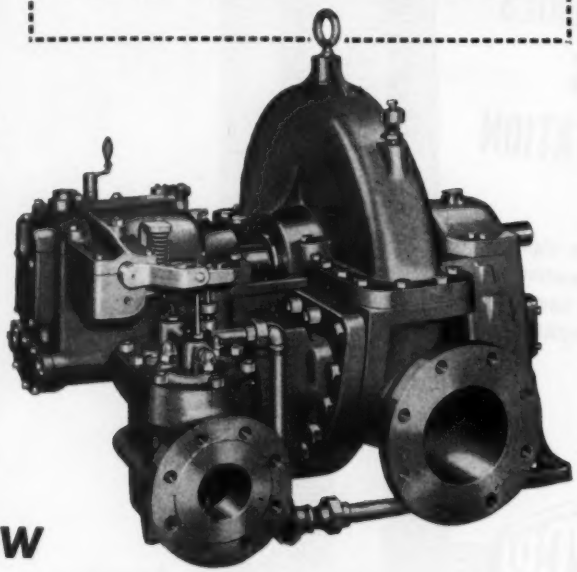
# NEW!
# MURRAY
## TYPE H
## MECHANICAL DRIVE SINGLE STAGE STEAM TURBINE



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Combining a host of new improvements plus time tested features, the Murray Type H offers extra-value in a medium size machine. With a range of 50-200 H.P., depending upon speed and steam conditions, it is offered with either a 16 or 20" diameter wheel. 3" or 4" steam inlet sizes available. Steam conditions up to 600#, 750° and back pressures up to 150# can be used.

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**MURRAY IRON WORKS COMPANY**
**BURLINGTON, IOWA**

**BUILDERS OF STEAM POWER EQUIPMENT FOR THREE QUARTERS OF A CENTURY**


## More FREE BULLETINS

*Begins on page 167*

pressure sanitary pump in which the fluid end is hermetically sealed from the actuating parts. Used with homogenizers and for other process services. 4-page bulletin. Scott & Williams, Inc, Pioneer Div, Empire State Bldg, New York 1, N. Y.

### WELDING

**B50** **WELDING ALLOY SPECIFICATIONS CHART**—Contains specifications on 100 different low temperature welding alloys used in brazing, and hard surfacing of steel, alloy steel, etc. 6-page folder No. 246 P. Eutectic Welding Alloys Corp, 40-40 172 St, Flushing, N. Y.

**B51** **ARC WELDERS** — Bulletin "AC Arc Welders for Heliarc Welding" describes a complete line of transformer type welder for all applications of the Heliarc process, with charts, specifications and recommendations for automatic control panels, and Heliarc spot welder. Miller Electric Mfg Co, Appleton, Wis.

### OTHER EQUIPMENT

**B52** **POWER PLANT EQUIPMENT**—Covers the major steam and electrical products of the five Elliott plants. Material is organized into sections, one covering steam and related equipment such as turbines, condensers, heaters, and the other covering rotating electrical equipment. 16-page bulletin No. Q-14. Elliott Co, Jeannette, Pa.

**B53** **PNEUMATIC STANDARDS** — Pneumatic standards for industrial equipment as recently approved by the Joint Industry Conference are reproduced in full, with sample circuit, glossary of terms, two pages of standard symbols, and comparison data on Miller air cylinders. 12-page booklet. Miller Motor Co, 4027 N Kedzie Ave, Chicago 18, Ill.

**B54** **VOLTAGE REGULATORS** — Describes the workings of Type IE and Type EM automatic Stabiline voltage regulators in maintaining a constant output voltage regardless of fluctuations in ac input line voltages and changes in output load. Outline drawings, performance data and rating chart given. 12-page bulletin No. S351. Superior Electric Co, Bristol, Conn.

**B55** **UNIT OIL COOLERS** — Design features and physical dimension data on non-ferrous tube-and-fin type unit oil coolers, available in nine physical sizes. Units are used for oil cooling where cooling water is scarce and/or the waste heat can be utilized to warm room interiors. 2-page bulletin No. 3550. Young Radiator Co, Racine, Wis.

**B56** **PIPE COVERING**—"The Story of Kaylo" describes Kaylo calcium silicate products and their various uses. Section is devoted to research and development history of hydrous calcium silicate products and description of its properties. 24-page booklet. Kaylo Div, Owens-Illinois Glass Co, Toledo 1, Ohio.

**B57** **DIESEL ELECTRIC SETS** — Illustrates the usage of diesel electric sets on various power applications and outlines specifications of models ranging from 21 kw to 314 kw. Chart for self-regulated and externally-regulated sets featured. 16-page bulletin No. 30178. Caterpillar Tractor Co, Peoria 8, Ill.

---

**Texas Gas Transmission Corp** outlined before the eFderal Power Commission plans for a $45.3 million pipeline project that will bring more natural gas to defense industries and homes in seven Midwestern states and the Appalachian area. The company asked the FPC to authorize a 600-mile pipeline expansion that would raise daily delivery capacity by 240 million cubic feet to over 900 million cubic feet a day.

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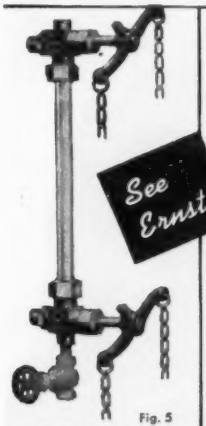



Fig. 5

Standard vertical bronze water-gage, 350 pound design, heavier construction up to 450 lbs. Stainless and forged steel for higher pressures.

Fig. 8

All iron gages for pressure up to 250 lbs., heavier construction up to 350 lbs.

Fig. 8SS—Same fittings made in stainless steel.

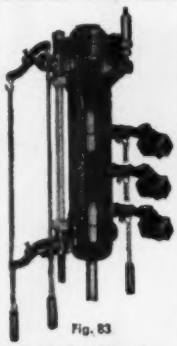


Fig. 83

No. 5 high and low alarm column with vertical gages and DCP weighted type try cocks.

Wire or Phone Ernst

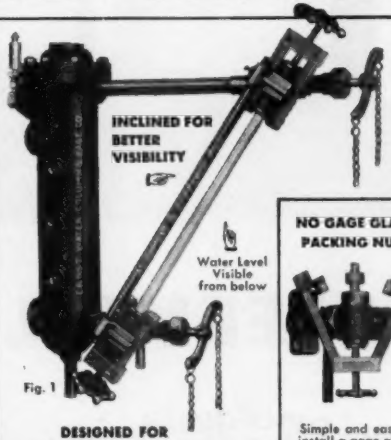
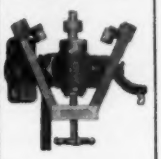



Fig. 1

**DESIGNED FOR 250-450-650 LBS. W.S.P.**

High and Low Alarm Column Equipped with Split-Gland Type Adjustable Inclined Water Gage

**NO GAGE GLASS PACKING NUTS**



Simple and easy to install a gage glass. No wrenches or tools required. A turn of the hand wheel compresses the packing.

## Insure Safety with ERNST INSERTS

**Mica-protected Flat Glass and PRISMATIC REFLEX**

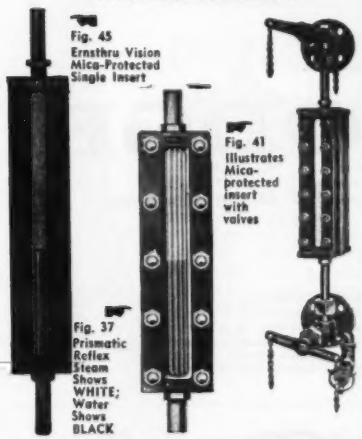


Fig. 45 Ernsthru Vision Mica-Protected Single Insert

Fig. 41 Illustrates Mica-protected insert with valves

Fig. 37 Prismatic Reflex Steam Shows WHITE; Water Shows BLACK

Fig. 10 Plain Sight Illuminator

Fig. 31 Ernst Plastic Guard, Replaceable Plates

## ERNST LEAKLESS TRY COCKS

*Designed for 450-650-1500-2500 lbs.*

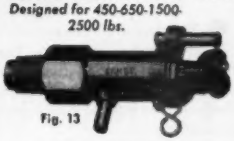


Fig. 13

Ernst Leakless Try Cocks Assure Maximum Safety

**Weighted Type Try Cock**

Fig. 15

250 lb. Pressure, Bronze, with Iron Weight Double Chain Pull

Fig. 06

Bronze, with Wheel

Spring Type Fig. AS-250

## SIGHT FLOW INDICATORS for insertion into pipelines

*"See what's going on" . . . inside*

Fig. 17-28 Tubular Glass Type

Fig. E-811 Flapper Type Single Window

Write Ernst

Fig. E-57 Bulls Eye Type Double Window

## GAGE GLASSES—Tubular and Flat Type

ALSO LUBRICATOR, SQUARES AND CIRCLES TO SPECIFICATIONS

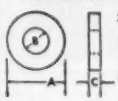
FLAT TYPE REFLEX AND CLEAR

CLEAR AND RED-LINE MAGNIFYING TYPE

**WHAT YOU NEED, YOU PAY FOR, WHETHER YOU BUY IT OR NOT**

## High Pressure Composition RUBBER GASKETS

Manufactured in all sizes to fit your water gages




Specify:

B—Inside Diameter

A—Outside Diameter

C—Thickness

Fig. 21—Lip Mold Rubber Gasket

Fig. 22—Standard Rubber Gasket

# SLEEVOIL

## -the super-quality fan bearing for mechanized draft installations!

● Hundreds of generating plants in America run on Dodge Sleevoil Bearings. These famous bearings combine quietness, long life and dependability to a degree unique in the bearing field. They offer engineers of costly power plants a priceless safeguard for their equipment.

Sleevoil Bearings are a Dodge development—created especially to meet the exacting requirements of fan and blower service. They are ideal bearings for important installations calling for induced or forced draft. Designed in cooperation with engineers of leading fan and blower manufacturers, they have a long record of dependable performance in critical service.

Dodge Sleevoil Pillow Blocks are normally available from stock—in both plain and water-cooled types, in shaft sizes from 1-7/16" to 8". Write us for information.

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*of Mishawaka, Ind.*

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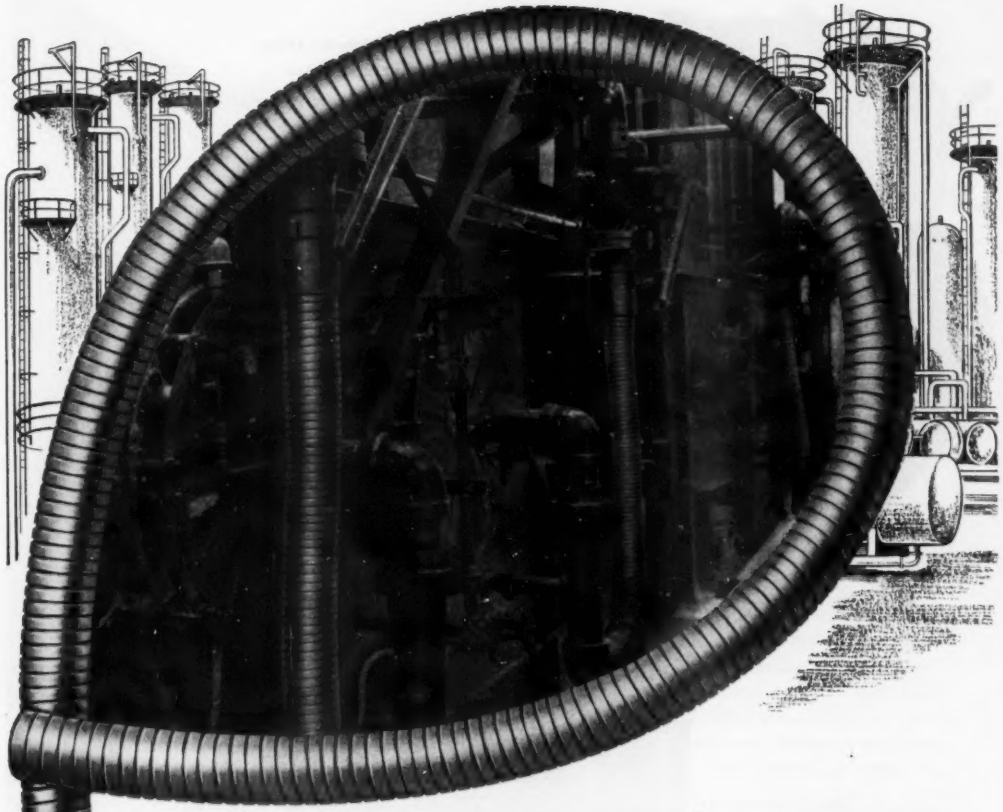
SEALED-LIFE V-BELTS; TAPER-LOCK SHEAVES

TORQUE-ARM SPEED REDUCERS

DODGE-TIMKEN PILLOW BLOCKS

ROLLING GRIP AND DIAMOND D CLUTCHES

FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY, CHICAGO THRIFT-ETCHING CORPORATION, 1555 SHEFFIELD AVENUE, CHICAGO 22, ILLINOIS



# CORRUGATED "MUSCLES" THAT LET PIPES MOVE

**PENFLEX METAL HOSE ABSORBS THERMAL EXPANSION . . . PREVENTS JOINT LEAKS**

Petroleum still burners like this one in Kermit, Texas, put heavy strains on piping. Thermal expansion, contraction and physical shock make safe sealing of burner pipe joint assemblies a vital requirement.

Penflex flexible metal hose with couplings is used on these burners to absorb any pipe movement due to extreme temperature and pressure changes. Lengths of 4" I.D. interlocking, four-wall galvanized steel hose are installed on each burner. Provides outstanding safety and high, uninterrupted flow of volatile fluids. Leakproof, tough and *flexible*.

Penflex engineers can help you solve flexible tubing application problems. Penflex manufactures a complete line of four-wall, interlocking and seamless welded corrugated tubing . . . from ⅛" I.D. and up . . . automatic barrel fillers, accessories and fittings. Write for illustrated folder, "Flexineering," containing valuable flexible tubing data for your product application.

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***Branch Sales Offices:*** **Boston • New York • Chicago • Houston • Cleveland • Los Angeles**

**penflex**

**HEART OF INDUSTRY'S LIFE LINES**

One of the two 610 hp CP Diesel engines operating at elevation of 2970 feet in Cartago, Colombia.

# ANOTHER COMPLETE CP DIESEL ENGINE INSTALLATION IN SOUTH AMERICA

For its new municipal power plant, the City of Cartago, Colombia, after careful consideration, selected CP Diesel engine equipment consisting of two 610 hp, 514 rpm units, for driving 400 kw generators.

The entire plant, including building, accessories and provision for future expansion, was designed, engineered and erected as a single project, and then turned over to the City of Cartago ready for operation.

This is a typical example of how CP service can relieve a customer of all the technical problems and details involved in the design and installation of a complete Diesel-electric power plant.

CHICAGO PNEUMATIC TOOL COMPANY

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*(a patented alloy)*

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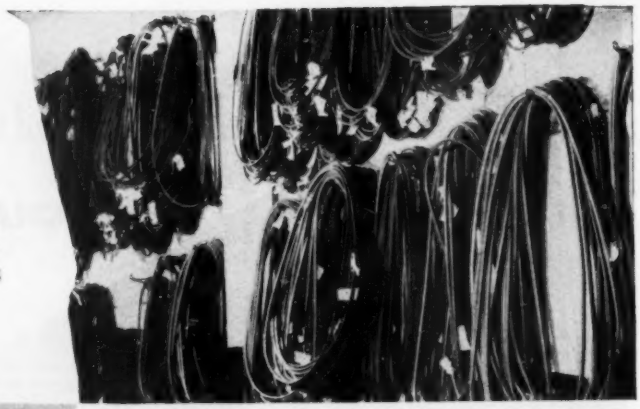
When you switch to Veelos—the adjustable v-belt—you end for all time the storage problem, the inventory control problem and the "frozen investment" problem that come with carrying this expensive, space-wasting stock of endless v-belts.



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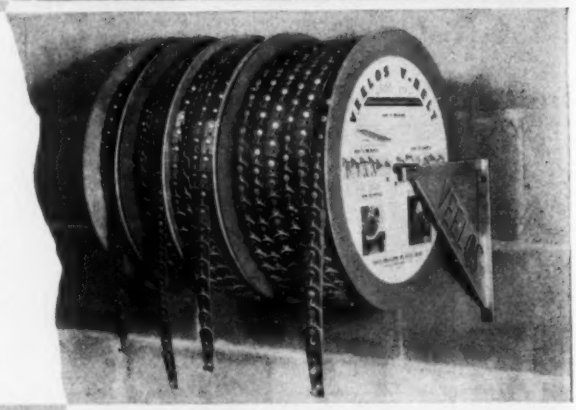


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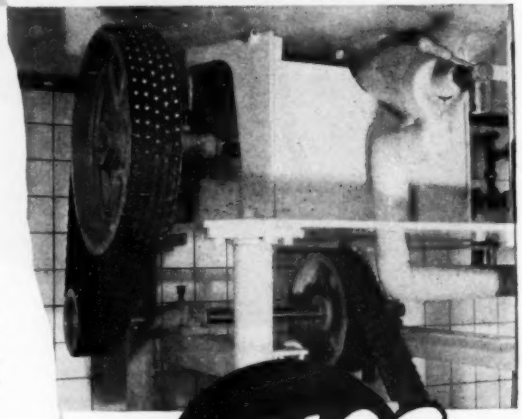
**We have a copy of the VEELOS DATA BOOK for you**—write today and we'll send you this complete story on Veelos—the adjustable v-belt.



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THE LINK
**V-BELT**

**ADJUSTABLE TO ANY LENGTH • ADAPTABLE TO ANY DRIVE**

Made in all widths in three types: regular, oil-proof, static conducting. Also double V in A and B. Packaged on reels in 100-foot lengths. Sales engineers in principal cities; over 350 distributors throughout the country. VEELOS is known as VEELINK outside the United States.

**MANHEIM MANUFACTURING & BELTING COMPANY • MANHEIM, PENNA.**

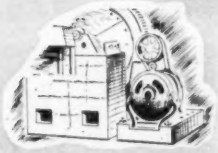
## WHERE TO USE LUMNITE IN POWER PLANTS

Steel Stack Linings

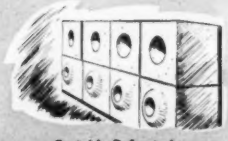
Ash Pit and Cinder Catcher Linings

Coal Bunker Linings

Flue and Duct Linings



Overnight Structural Concrete

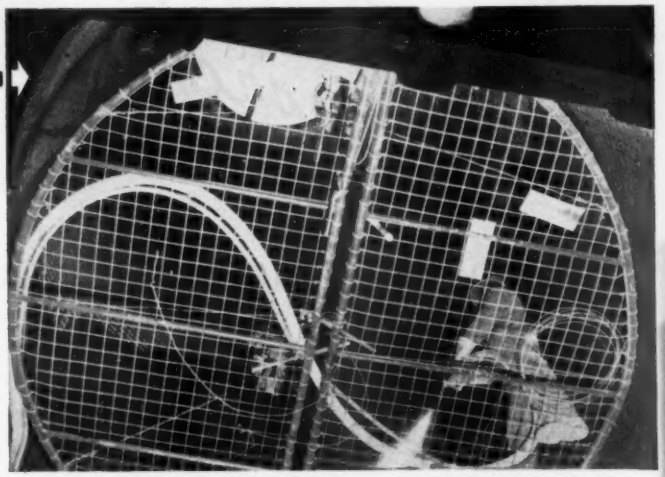


Castable Refractories

*Factory-prepared mixtures of LUMNITE and selected aggregates. Mixed with water on the job, cast into place for door linings, arches, baffles, furnace walls. Special shapes can be cast in molds, ready within 24 hours. Castables to meet different temperature and insulation needs are made by manufacturers of Refractories, sold by their distributors.*

# Lining steel stacks with LUMNITE*

# STOPS CORROSION IMPROVES DRAFTS



**Looking up through working platform** in stack being lined with Lumnite refractory concrete. 2½" lining is being "shot" by concrete gun over reinforcing mesh attached to angle plates welded to steel shell.

**CORROSION,** the No. 1 enemy of steel stacks, won't harm this one. It's getting a protective lining of refractory concrete made with Lumnite calcium-aluminate cement. The Lumnite concrete will resist corrosive attacks of condensate and sulphurous gases. In the breechings, it will withstand the abrasive action of high-velocity gases and fly ash.

Drafts will be boosted, too. Lumnite cement, mixed with insulating aggregates, keeps gas temperatures high, cuts condensation inside the stack. And because the lining is smooth and jointless, there will be less loss of draft.

### Easily Installed – Maintenance Reduced

Lumnite linings may be troweled into place or "shot" on by concrete gun as shown above. Because Lumnite linings are jointless, there are no small units to work loose. Thus less maintenance is required. When repairs are necessary, they can be made quickly and cheaply, for Lumnite reaches full service strength in 24 hours or less.

Depending on requirements, Lumnite provides high structural strength, high heat resistance and low thermal conductivity. Write for descriptive booklet on Lumnite for stacks, and other refractory, insulating, corrosion-and heat-resistant concrete installations in power plants, to: Lumnite Division, Universal Atlas Cement Company (United States Steel Corporation Subsidiary) 100 Park Avenue, New York 17, N. Y.

**"LUMNITE" is the registered trade mark of the calcium-aluminate cement manufactured by Universal Atlas Cement Company.*

P-L-32R

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2. GARLOCK *Lattice-Braid*—a patented braided packing, made of asbestos, flax or cotton—in which all strands are lattice-linked together into a sturdy and flexible unified structure.
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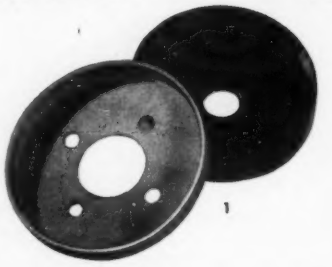
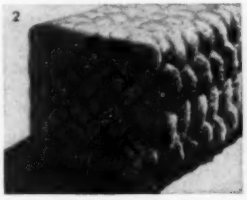
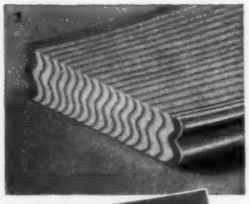
4. GARLOCK *Chevron** Packing—an automatic packing made of asbestos or cotton base materials—accurately molded into rings of any size. Chevron packs high pressure jobs or low pressure jobs with minimum friction and wear.
5. GARLOCK *KLOZURE** Oil Seal Models 53 and 63—tough, durable, resilient. Complete range of sizes, including Metric O.D.



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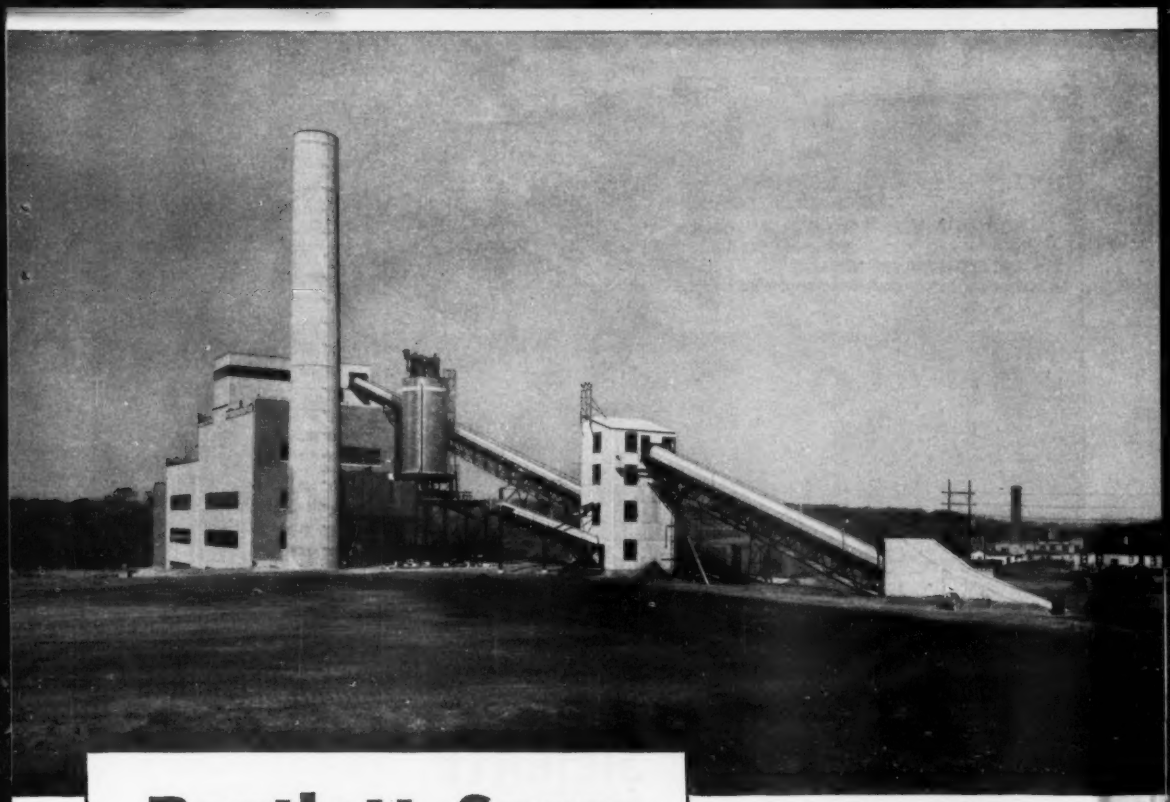


General View—Saybrooke Station
Central Illinois Elec. & Gas Co.
Stone and Webster Eng. Corp.
Constructing Engineers

# Bartlett-Snow coal handling at Rockford

● The illustration above shows the first 30,000 KW unit of a plant which is to be extended into a 110,000 KW station. All coal handling equipment including track hopper and grill, duplex feeder, conveyors, galleries, chutes, tripper and all supporting structures were fabricated in our shops, and installed by us, to Stone and Webster's plans. For efficiency, satisfaction, and fixed unit responsibility, let the Bartlett-Snow coal handling engineers, with their long experience and complete facilities work with you on your next job.

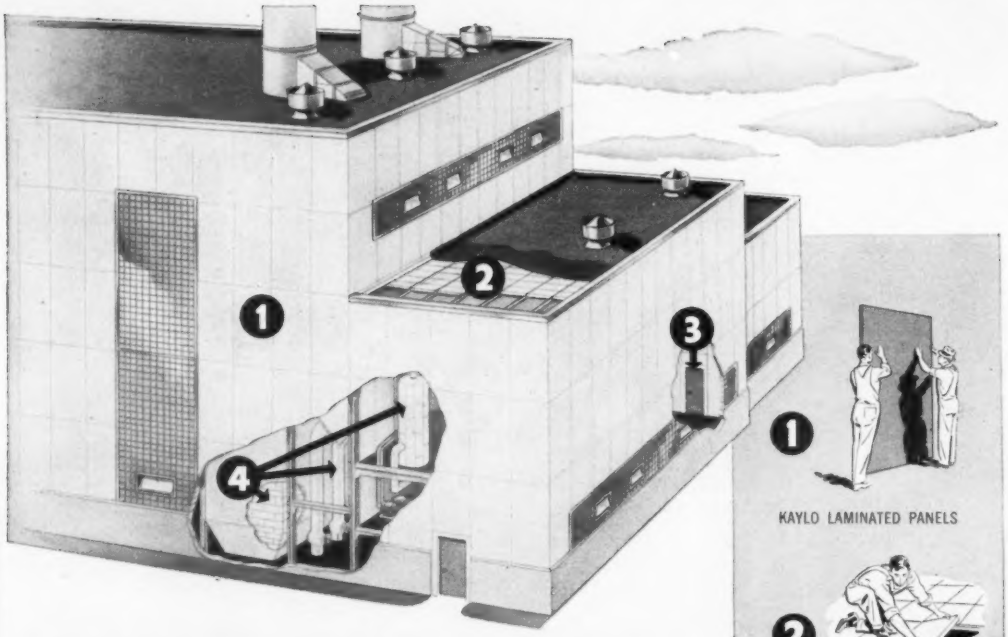
Belt Conveyor from
Track Hopper to Crusher House

View of Crusher House and
Stocking Out Conveyor

DESIGNERS
ENGINEERS

BARTLETT-SNOW
CLEVELAND 5, OHIO

FABRICATORS
ERECTORS

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## A Better Material For Many Uses

For better roof decks, walls and firedoors—and heat insulation for plant equipment—Kaylo hydrous calcium silicate offers an unmatched combination of advantages.

This versatile material—a chemical compound, *not glass* — is incombustible and inorganic; it resists moisture damage and other destructive elements. What's more, Kaylo calcium silicate has exceptional insulating value, dimensional stability, high strength and light weight—a basic advancement in building and insulating material.

For new construction, modernization or maintenance replacement, consider the advantages offered by products made of Kaylo calcium silicate. Get complete details on Kaylo products—write Dept. N-193, Owens-Illinois Glass Company, Kaylo Division, Toledo 1, Ohio.




KAYLO LAMINATED PANELS

KAYLO INSULATING ROOF TILE

KAYLO-CORE FIREDOORS

KAYLO HEAT INSULATION

**KAYLO**® ... *first in calcium silicate*

...*pioneered by* OWENS ILLINOIS **Glass Company**

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DRY MATERIAL CONVEYING SYSTEMS AND COOLERS
COMPRESSORS AND VACUUM PUMPS
FEEDERS, AND ASSOCIATED EQUIPMENT

sound
lungs
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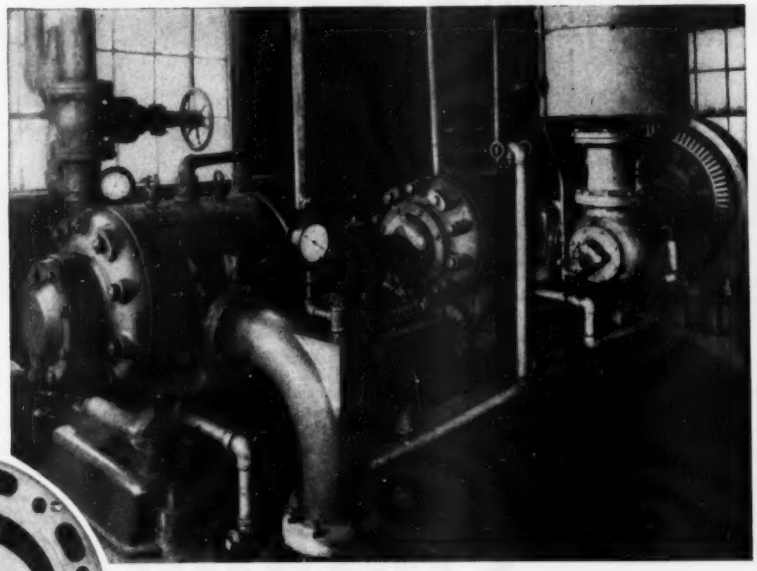
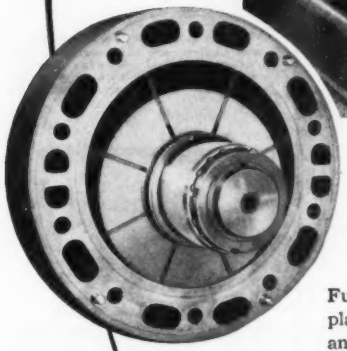


Forging Plant: Two-stage rotary compressor. Capacity 1665 c.f.m., 100-lb. pressure.



# FULLER rotary compressors

Fuller Rotary Compressors are first choice for dependability in many plants the country over. That's only natural, because Fuller engineers and builds for trouble-free, long-term, low-cost operation. Fuller Rotary Compressors have but few moving parts . . . rotor, bearings, and blades. They need little attention, infrequent inspection. Maintenance is low . . . there are no valves to leak or seats to grind; blades automatically compensate for wear. ***Full capacity is maintained for the life of the machine.***

It's this lifetime of new machine efficiency that makes them the logical, economical choice of many engineers and plant superintendents . . . means many repeat orders for Fuller Rotaries. They can't be beat as prime factors in reducing installation as well as operating costs.

A Fuller engineer will be glad to show you how Fuller Rotary Compressors can go on your payroll at the minimum wage. Get in touch with him today . . . or write for Bulletin C-5, which describes Fuller Rotaries in detail.

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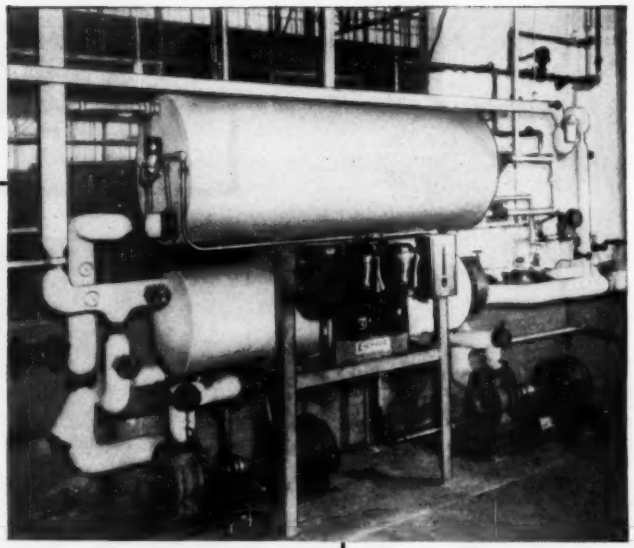
# SCHAUB

## BOILER RETURN SYSTEMS



A duplex S5K-D Schaub deaerating type Boiler Return System in modern Chicago industrial plant. Equipment includes Model 2084 feed water heat exchanger, and serves a 200 HP, 200-lb. W. P. boiler.

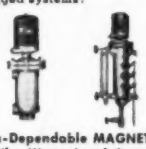
# You Get All These Features ...in a SCHAUB

Only Schaub offers you the combined exclusive *money-saving* features illustrated at the right. Any one of these alone would be a sound reason for buying a Schaub System over any other. Take time to compare details. Then you'll quickly see why Schaub gives you *more* for your money on *every* feature. In terms of real savings—you get improved operating economy, lower maintenance costs and longer equipment life. All this means your return system costs you less per year. Know the facts and you'll readily recognize that a Schaub Boiler Return System is your best value.

**Get the Facts!** The complete story of how much more you get when you specify a Schaub System is quickly presented in Catalog 55. Write for your copy NOW—it's free!

**Schaub Master-Bilt Turbine Pump**
Patented fleximatic shaft seals and pre-lubricated ball bearings mean no packing and no greasing—ever! When you install a Schaub Master-Bilt Pump, you can forget about it.

**Chromosoid-Lined Receiver**
10-year guarantee against corrosion. Schaub engineers developed Chromosoid lining by working with leading chemical researchers. You're protected from costly and premature replacements. No more rust-clogged systems!



**Ultra-Dependable MAGNETROL Boiler Water Level Control**
Combination pump-control and low water safety cut-off. Friction-free Magnetrol, assures boiler safety. No bellows to stiffen, no packing in head, no tricky electrode circuits to fail. All models approved by Underwriters' Laboratories, Inc.

**FRED H. SCHAUB ENGINEERING CO.**

**2105 S. Marshall Boulevard • Chicago 23, Illinois**

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**A wrought, age-hardenable, corrosion-resisting alloy**

Duranickel® is a wrought, non-ferrous, slightly magnetic alloy. It has the higher strength found only in the heat-treated alloy steels, and not offered by other corrosion-resisting alloys available at comparable cost levels.

The principal engineering characteristics of Duranickel are:

● **Mechanical Properties:** The accompanying table shows the ranges of Ultimate Tensile Strength, Yield Strength, Elongation, and Hardness values for various forms and conditions of Duranickel.

● **Shear Strength:** Values for the ratio of maximum shearing strength to ultimate tensile strength range from approximately 0.5 to 0.6 and are comparable to those of mild and low-alloy steels.

● **Endurance Limit:** In rotating beam tests of polished specimens at room temperature and 10,000 rpm for $10^8$ cycles, Duranickel hot-rolled showed an endurance limit of 51,000 psi.; hot-rolled, age-hardened showed 52,500 psi.; cold-drawn 51,000 psi.; and cold-drawn, age-hardened showed 61,000 psi.

● **Impact Strength:** Charpy impact strength ranges from 240 ft. lb. for hot-rolled Duranickel and 190 ft. lb. for cold-drawn, to 40 ft. lb., for the age-hardened condition.

● **Spring Properties:** Duranickel wire can be cold-drawn and age-hardened subsequently to develop tensile strength of the order of 225,000 psi. The torsional proportional limit of cold-drawn and age-hardened wire is about 40 per cent of the ultimate tensile strength. Duranickel springs are used at temperatures up to 550°F.; the stresses used should be governed by existing service conditions.

● **Working Characteristics:** Duranickel may be hot-worked, forged, and cold-worked. It can be machined most readily in the annealed condition and is commercially machinable in other conditions at hardnesses up to 275 BHN. The use of a cutting lubricant is essential for all machining work because Duranickel, like all high-nickel alloys, is characteristically "sticky" and tends to gall or build up on the tools. Duranickel can be joined by the usual welding, brazing and soft soldering processes common to industry.

● **Variants:** For special uses there are two alloys similar to Duranickel. They are: (1) Duranickel "R" containing a higher percentage of carbon for use where applications require optimum machinability. (2) Permanickel® having the same mechanical properties as Duranickel but different physical constants, particularly better electrical and thermal conductivity and stronger magnetic properties. Permanickel is preferred for service as springs requiring high electrical conductivity; equipment requiring good thermal conductivity and magnetostrictive units where high fatigue strength is required. Special applications include thermostat tension springs, reaction springs, clips, grid wires and side rods in vacuum tubes.

● **Corrosion Resistance:** The corrosion resistance of Duranickel in all its forms is of the same order as that of nickel to a wide variety of media, including mineral and organic acids, alkalies, salts, potable and industrial waters, food products, organic compounds and oxidizing atmospheres at normal and elevated temperatures.

● **Forms Produced:** Duranickel is supplied in most commonly used mill forms—rods, hexagons, squares, rounds, flats, strip, sheet, wire and welding materials.

● **Applications:** Duranickel is used in many applications where corrosion resistance, high hardness, and great strength are required. In the production of plastics, Duranickel is a standard material for dies, injection cylinders and extrusion screws. Duranickel springs, from both wire and strip, give excellent service. Instrument parts include diaphragms, bellows, flapper valve discs, snap switch blades, and grid wires and side rods in vacuum tubes.

## Mechanical Property Ranges of Duranickel

| Form and Condition | Tensile Strength 1000 psi. | Yield Strength (0.2% offset) 1000 psi. | Elongation in 2 in. per cent | Hardness Rockwell C |
|---|---|---|---|---|
| **Rod and Bar** | | | | |
| Hot-finished | 90-130 | 35-90 | 55-30 | 75B-22 |
| Hot-finished, age-hardened | 160-200 | 115-150 | 30-15 | 32-42 |
| Cold-drawn, as-drawn | 110-150 | 60-130 | 35-15 | 90B-32 |
| Cold-drawn, age-hardened | 170-210 | 125-175 | 25-15 | 32-42 |
| **Strip** | | | | |
| ½ hard | 130-155 | ..... | 15-3 | 25-34 |
| ½ hard, age-hardened | 170-210 | ..... | 20-7 | 33-42 |
| Spring | 155-190 | ..... | 10-2 | 30-40 |
| Spring, age-hardened | 180-230 | ..... | 15-5 | 36-46 |
| **Wire** | | | | |
| Spring | 160-200 | ..... | 5-2 | ..... |
| Spring, age-hardened | 200-240 | ..... | 10-5 | ..... |

**FURTHER DATA AVAILABLE**

A 22-page reference manual, *Engineering Properties of Duranickel*, Technical Bulletin T-32, contains all essential engineering information. It is available, free, for your files. For help on specific metal problems, write directly to Inco's Technical Service, outlining your problems.

**THE INTERNATIONAL NICKEL COMPANY, INC.**
67 Wall Street, New York 5, N. Y.

INCO TRADE MARK **Nickel Alloys**

MONEL® • "R"® MONEL • "K"® MONEL • "KR"® MONEL
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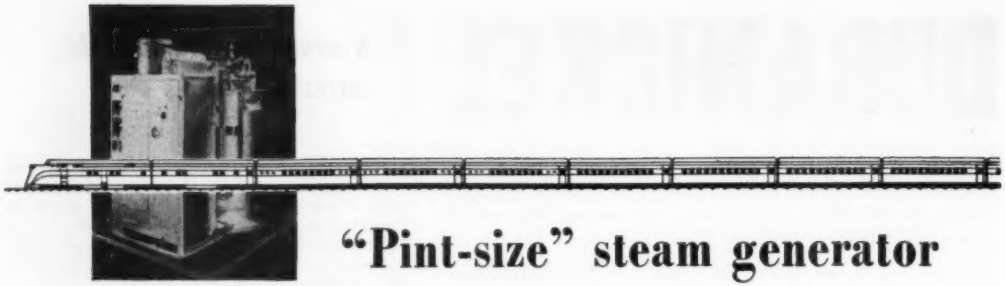
DURANICKEL® • PERMANICKEL®



# "Pint-size" steam generator warms a whole diesel train

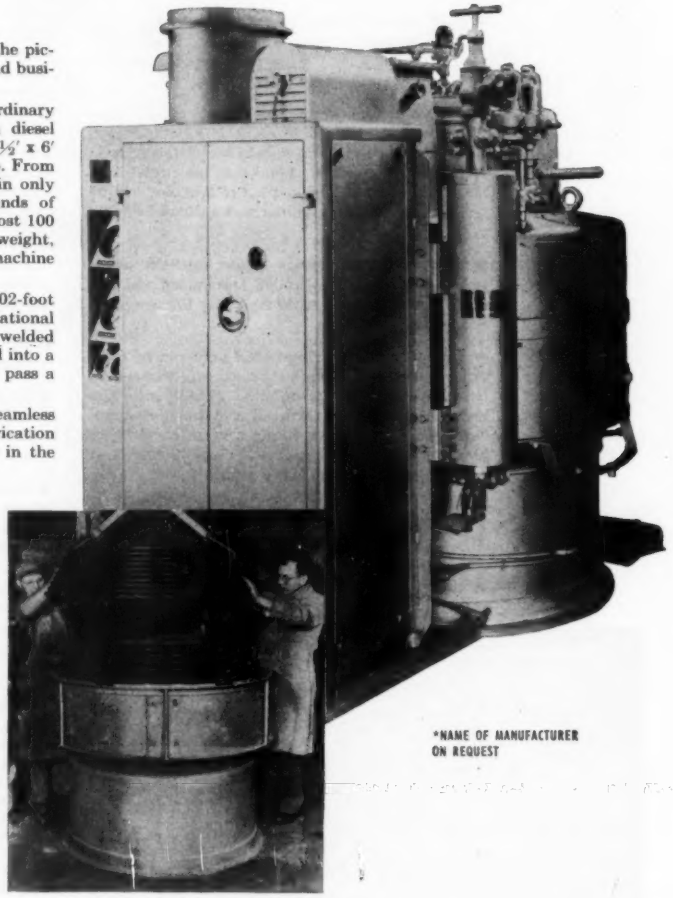
That Vapor-Clarkson steam generator* in the picture has caused a real stir both in the railroad business and out of it.

Even though it's no bigger than an ordinary clothes closet, it does the one big job a diesel locomotive can't do by itself—this 3½' x 5½' x 6' generator can heat an entire train. Fast, too. From a cold start, it will deliver 200 psi steam in only two minutes. Capacity is over 4500 pounds of steam per hour. That's enough to heat almost 100 homes in dead zero weather. For size and weight, this is the most powerful steam-making machine developed by industry.

Heart of this ingenious generator is a 702-foot long set of continuous coils made from National Seamless Steel Tubing. Standard lengths are welded into 200 or 300 foot lengths, then cold rolled into a coil. All coils are interchangeable. All coils pass a 1200 pound hydrostatic pressure test.

This is another instance of National Seamless doing a fine job, despite the exacting fabrication methods and rigorous tests. The reason is in the tubing itself—in that magic word, "Seamless." There aren't any longitudinal welds to weaken the tube. Each tube is pierced from a solid billet of steel . . . the *one* method that removes all doubt concerning wall strength.

When planning the use of seamless pipe or tubing for future needs, be sure to specify National Seamless, made by the world's largest and most experienced manufacturer of tubular steel products.



*NAME OF MANUFACTURER ON REQUEST

NATIONAL TUBE COMPANY, PITTSBURGH, PA.
*(Tubing Specialties Division)*
COLUMBIA STEEL COMPANY, SAN FRANCISCO
PACIFIC COAST DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

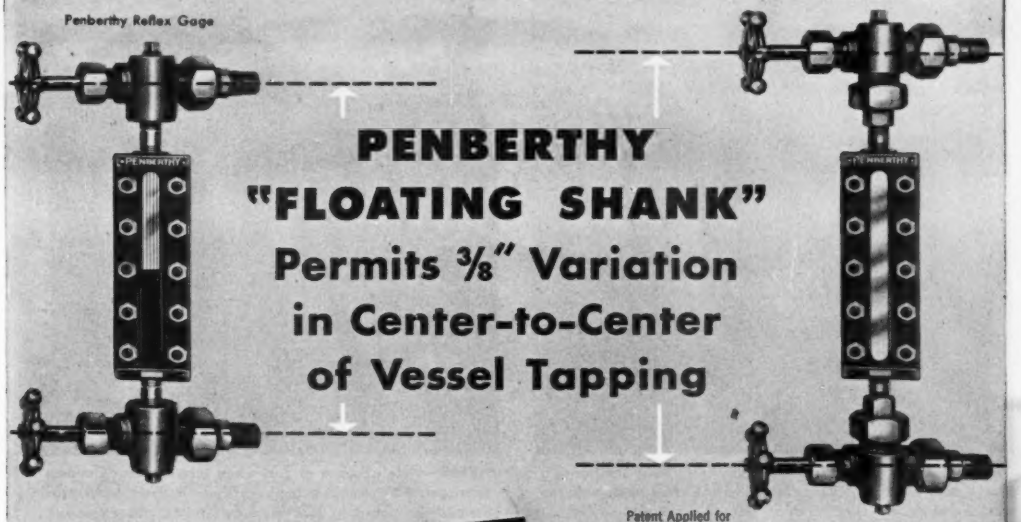
USS

**NATIONAL *Seamless* PIPE AND TUBES**

**UNITED STATES STEEL**

Penberthy Reflex Gage

Penberthy Transparent Gage



# PENBERTHY "FLOATING SHANK" Permits 3/8" Variation in Center-to-Center of Vessel Tapping

Patent Applied for

**COMPENSATES FOR VESSEL TAPPING INACCURACIES**

•

**SAVES INSTALLATION TIME**

•

**REDUCES GAGE STRESSES**

*Another* **PENBERTHY** *First*

An important new feature now available on all Penberthy drop forged steel gage valves is the "floating shank" . . . an improvement that has money-saving advantages to many users of liquid level and water gages.

The "floating shank" compensates for inaccuracies in the center-to-center distance of the tapped holes in the vessel on which the gage is mounted. The variation can be as much as 3/8". It provides a mounting flexibility not elsewhere obtainable . . . it saves time during installation of the gage . . . it eliminates stresses that are often induced during mounting.

The Penberthy "Floating Shank" can be had at slight additional cost . . . specify it on your next order for Penberthy drop forged steel (or alloy) gage valves.

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**Detroit 2, Michigan**

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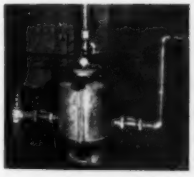
**PENBERTHY CYCLING JET PUMPS**

Automatically operated by air, gas or steam pressure . . . Will pump without clogging any liquid that will flow through pipes. Ask for Bulletin 5030.



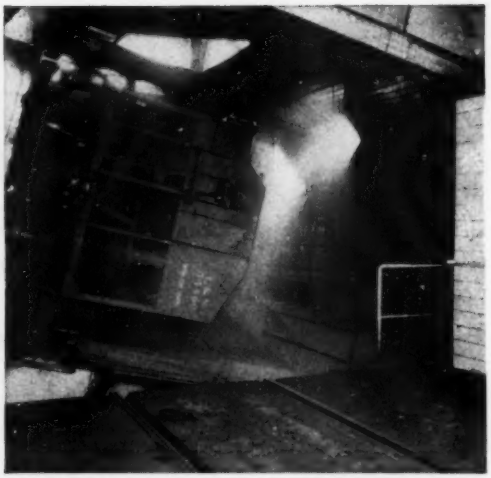
**PENBERTHY EXPLOSION-PROOF SUMP PUMPS**

Motor and switch totally enclosed. Underwriter approved for Class 1, Group D, and Class 2, Groups E, F and G hazardous location. Made of copper and bronze throughout. Ask for Bulletin 4929.

**PENBERTHY EJECTORS**

A simple jet pump operated by air, water or steam. Needs no lubrication . . . will not get out of order. Ask for Bulletin 5080.

**BEFORE**—Johnson-March system turned off at car dumper of a large midwest utility. Compare this unretouched photo with the one at the right.



**AFTER**—Note absence of dust when Johnson-March system is operating at this same dumper. These systems have proved themselves in many plants. We'll be glad to furnish names.

# STOP COAL DUST

## at 1/10 the usual cost!

If you have a dust problem—no matter how large or small—no matter where the dust occurs . . . car dumpers, hoppers, crushers, belt galleries, or coal pile—it can be controlled or eliminated with a Johnson-March liquid diffusion system. Installation is fast, simple, and inexpensive. There is no interference with normal plant operations.

No ducts, no fans and no cumbersome equipment are required. Johnson-March compounds added to water and a carefully engineered spray system do the work. The system is guaranteed effective, but its operation is simple. It costs far less than other types of dust handling systems—in most cases only 1/10 as much. And maintenance costs next to nothing!

Even though you may have a mechanical dust collecting system, it will pay you to investigate a Johnson-March system.

Without cost or obligation, why not have one of our engineers discuss your dust problems with you? Just drop us a line or mail the attached coupon.

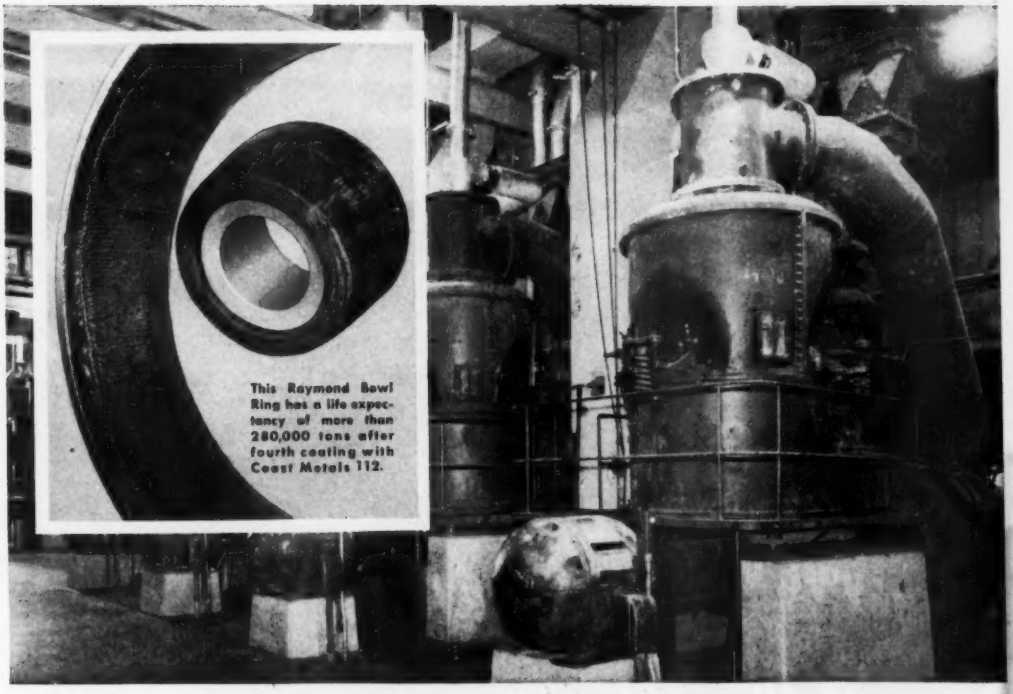
**THE JOHNSON-MARCH CORP.**
**1724 Chestnut St., Philadelphia 3, Pa.**
Without cost or obligation, I would like to know more about the Johnson-March system of low-cost dust control. P-1

Name.....
Company.....
Address..... State.....
City.....

**Johnson March**

*Specialists in Liquid Diffusion*

**1724 CHESTNUT STREET** **Philadelphia 3, Pa.**




# Raymond Ring Hard-Faced with Coast Metals Alloy PULVERIZES 210,000 TONS OF COAL

## CM-112 applied to Ring and Grinding Rolls increases life by more than 3 to 1

The Raymond Bowl Ring pictured above was photographed at a large Ohio utility plant. It has pulverized a total of 210,000 tons of coal, at 100% rated capacity, on 3 separate hard-facings with Coast Metals Alloy 112. A fourth facing, now being applied, will give this unit a life expectancy of at least 280,000 tons.

Life of uncoated rings is about 65,000 tons, after which they must be replaced. Efficiency drops off sharply after approximately 30,000 tons and the result is that production costs of remaining tonnage run high.

The history of this ring, therefore, clearly illustrates the tremendous advantages gained by Coast Metals hard-facing—proves that hard-facing with CM Alloys *pays off in a big way*.

There are many other examples of how CM Alloys extend the life of parts subject to impact, abrasion, and high heat during operation: Bowl mill deflector castings and sideliner wear plates—ring retainer lugs—coal feeder screws—sluice liner castings—clinker crusher rolls—ID fan float liner plates—exhauster fan blades and impact mill plows, when hard-faced with CM *stay on the job* and continue to perform efficiently *long after* unfaced parts have become too worn to use and must be replaced.

Holding down production and maintenance costs has never been so important as it is today. So don't *replace—reface* with CM specialized weld rods. You'll not only keep production running smoothly, but save money. We shall be glad to make recommendations based upon your particular needs.

**COAST METALS, Inc.**

*Little Ferry, N. J.*

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We met the challenge of the oil country years ago with instruments that have given oil men a new conception of lasting accuracy in pressure gauges and dial thermometers. There could be no higher tribute to Marsh quality, stamina, and precision than the preference shown for Marsh instruments throughout the country where "they've got to be right."

Not only in the petroleum field, but in every field where requirements are exacting, Marsh Gauges and Thermometers have become "The Standard of Accuracy." That's why you find Marsh gauges on leading makes of boilers, pumps, compressors and other equipment requiring pressure gauges. That is why you should insist on Marsh for every gauge or thermometer need throughout your plant.

This recently developed "Xmas Tree" Gauge for oil wells is typical of the wide range of Marsh Gauges for all services.

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*** 2,800,000 C. F. M. . . . 120 AIR CONDITIONING SYSTEMS . . .** *showing 5 of the 324 Clarage Fans delivering conditioned air to manufacturing areas.*

*** Upjohn**

***installs***

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***Fine Pharmaceuticals!*** . . . the making of over 700 different kinds has started in this great plant of the Upjohn Company, 10 minutes south of Kalamazoo.

Here much of the manufacturing . . . ***to maintain integrity of product*** . . . is dependent upon air conditioning. 120 complete systems handling 2,800,000 c.f.m. are installed.

*" " " " " "*

*A multimillion dollar project... Engineers and Builders, The Austin Company, Cleveland.*

*" " " " " "*

Upjohn has had more than a quarter-century of experience with Clarage Equipment. It well may be that this was the deciding factor in selecting Clarage ***HEAVY-DUTY*** Fans for ***every one*** of the air conditioning systems operating in this new Upjohn plant.

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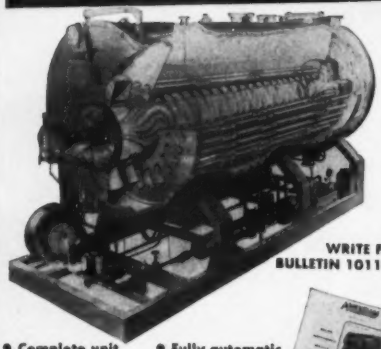

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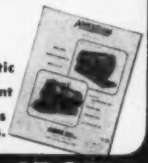

- Complete unit
- Fully automatic
- Easily installed
- Highly efficient
- Oil, gas or oil-gas combinations 10 to 500 h.p. — 15 to 200 lbs.

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BOX 2708 OSWEGO, N. Y.

Builders of Better Boilers since 1848

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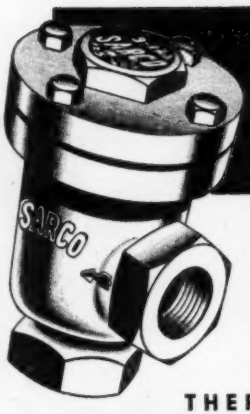

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For draining condensate and eliminating air from pipe line heaters, tracer lines, storage tanks, cabinet heaters, loading racks, rail and switch heaters and similar out-door equipment, use

## SARCO THERMOSTATIC STEAM TRAP NO. 9

They are unrivaled for this service because they require no protection against freezing. They are small in size, as easy to install as a pipe elbow. Will operate equally well on low or high pressure without requiring seat change.

Available with bellows of bronze, monel or stainless steel for pressures to 300 psi.

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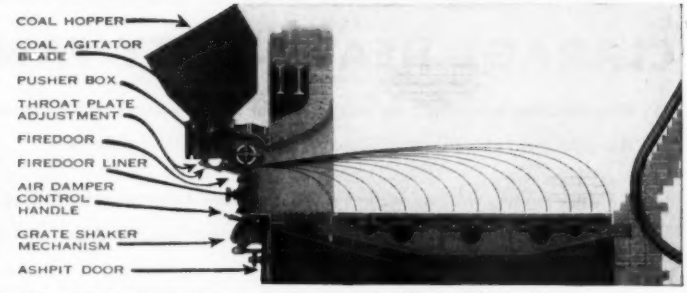
# CHICAGO AUTOMATIC
## Unit Drive
# SPREADER STOKERS




Spreader stoker firing with a Chicago Automatic is economical firing. Check these important features which assure efficient and reliable operation:

- ✓ Fuel handling flexibility—adaptable to a wide range of coal sizes either wet or dry.
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*For complete information write Dept. F. 3 for Publication No. 85* ●

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## is the KEY

## TO LOWER COAL HANDLING COSTS

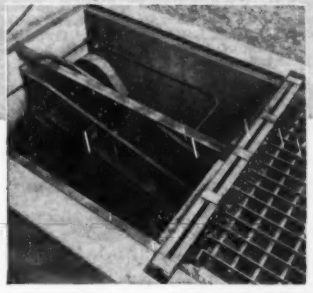
*See How G-W does it with **Four** basic designs!*

This installation at Universal Match Corporation, Hudson, N.Y., is one of **four basic types* . . . evolved by G-W to simplify design, manufacture and erection of dependable coal storage and handling equipment. G-W engineers recommend its cylindrical steel tank type of storage because it required the least amount of space and attention . . . is clean and economical to install and maintain.

Auxiliary equipment consists of feeder and conveyor from truck and track hoppers and bucket elevator to 90 ton tank at 25 tons per hour. Coal is discharged direct from storage to stoker hopper.

### 4 BASIC WAYS TO CUT COAL HANDLING COSTS

Showing bar feeder in hopper delivering coal to screw conveyor.



*The other three G-W basic types of coal storage systems are: reinforced concrete silo, vitrified tile silo, suspended steel bunker . . . the result of over 135 years of experience in installing hundreds of coal handling systems. Why not consult a G-W engineer? He will be glad to show you how one of these four basic designs can simplify your coal handling problems . . . reduce your costs.

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Bulletin No. 300 describes 14 case histories utilizing these 4 G-W basic types. Write for your copy today.

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"PACKAGED" STEAM GENERATOR
WITH EXCLUSIVE OFF-CENTER FIRING

## SHOWS BIG SAVINGS!

**HERE'S WHAT OFFICIALS SAY AT W. B. PLACE & COMPANY, HARTFORD, WIS., CUSTOM DEERSKIN TANNERS:**

*"We are very much pleased with the Dutton gas-fired boiler . . . it has done an excellent job of heating, and been practically trouble free."* As to cost of operation, *"our bills to date indicate a substantial saving . . . a big saving in labor."*

From the installation picture, you might compare the *appearance* of these boilers—but where *efficiency* begins, comparison ends! The compact Dutton EconoTHERM produces *160 h.p.*, against *90 h.p.* for the space-consuming old boiler beside it. From a cold start, the Dutton will produce 125 lbs. of steam pressure in just 15 minutes. The old unit took 2½ hours!

In Hartford—or wherever they're installed—"packaged" EconoTHERMS win praise for fuel efficiency, safety and durability. Delivering *twice* the power you'd expect in *half* the usual space, the EconoTHERM is self-contained, with fully automatic controls.

*Exclusive* Dutton "off-center firing" with rotary combustion gives you faster boiler water circulation, plus greater safety. Other features include: Large steam storage space . . . five or more square feet of water heating surface per rated h.p. . . . mechanical draft with short stack (no costly chimney) and choice of gas or oil firing.

**Learn about *all* the quality features of the Dutton EconoTHERM . . . WRITE NOW FOR BULLETIN EC-100C**

Other types and sizes — 5 to 250 h.p.

**Dutton BOILER DIVISION**
HAPMAN-DUTTON COMPANY
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Boiler Makers Since 1880



# Are you equipped to hold your job?—to get a new one?

**The men who are keeping their jobs today—who are not feeling the whip of competition—are those who have kept one jump ahead of their jobs. They are the men who are equipped with a thoroughgoing and growing knowledge of the business they are in.**

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**joins Unibestos in the UNARCO line of asbestos pipe insulations**

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Answering the demand for a jacketed pipe insulation for use in the lower heat ranges, UNARCO now offers Amocel — for temperatures up to 650°F. Like Unibestos, Amocel is made of Amosite asbestos fibers bonded with an inorganic binder. For pipe sizes from ½" through 12", in Standard thickness only. Light in weight. Highly efficient. Durable.

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**. . . up to 750°F.**

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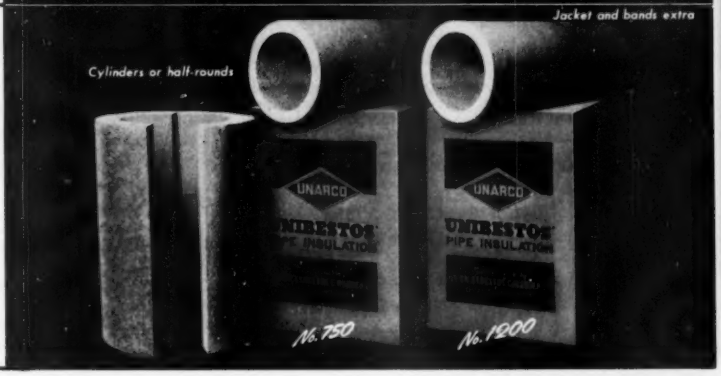
2 GREAT PIPE INSULATIONS — Unibestos No. 750 and No. 1200 — long have been America's outstanding insulations in their respective temperature ranges. Regular production for pipe sizes from ½" through 24" in popular thicknesses through 4". Other thicknesses and pipe sizes up to 44" o.d. of the insulation available.




**We want you to have our Catalog** — It gives you complete information on Amocel and Unibestos Pipe Insulations; Unibestos Insulating Block; Cements and Finishes; Flexible Insulations; Metal Mesh Blankets; Tailored-to-Fit Insulations; Asbestos Packings and Gaskets; Asbestos Textile Products . . . Just drop us a line today requesting that we send you UNARCO Catalog No. 76-109.

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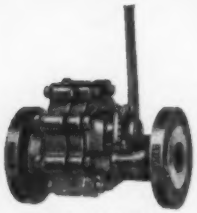
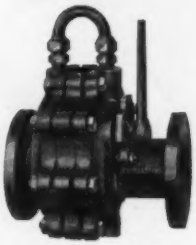
# EVERLASTING® VALVES

## *mean "Everlasting" Protection on these duties*



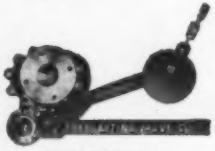
GENERAL SERVICE

Wherever frequent use and quick operation is required for any liquid or gas at pressures up to 300 psi. Have outside stuffing box and gland.



STEAM JACKETED

Assure continued free flow of any material which congeals at ordinary temperatures.



FIRE PROTECTION

Closing type for inflammable liquid emergency shut-off, or opening type for deluge or drainage, assuring immediate and positive action with weighted pendulum stop.

BOILER BLOW-OFF

Quick-opening, also handwheel operated Angle and "Y" types and combination units meeting ASME Code requirements for pressures up to 600 psi.

For more than 40 years, EVERLASTING VALVES have been known for their ingenious design, simple sturdy construction, and long trouble-free life with low maintenance expense. Some of their distinctive features are:

**Quick-Action** . . . opened or closed with less than a quarter turn of the operating lever.

**Straight-Through Flow** . . . the disc cannot become loose and accidentally check the flow.

**Drop-Tight Seal** . . . constant contact of disc and seat at all times prevents dirt or scale from getting between.

**Self Regrinding** . . . the disc rotates on the seat with each operation, thus regrinding the sealing surfaces.

**No Wedge Action** . . . all parts move between parallel faces.

*Write for bulletin describing EVERLASTING VALVES in detail.*

**EVERLASTING VALVE COMPANY**

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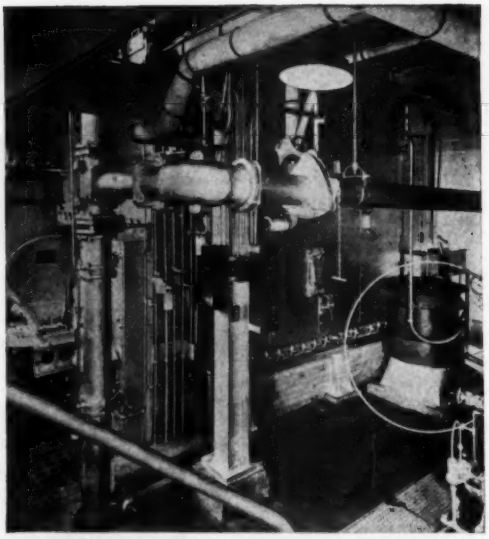

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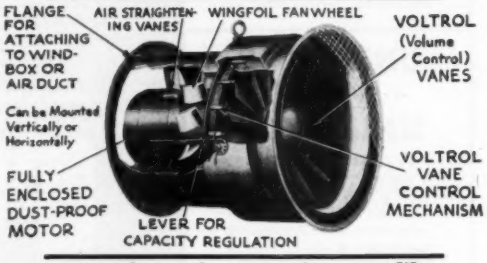
WING AXIAL FLOW BLOWERS are used on many of the country's leading makes of boilers as standard equipment. The reason lies in the consistently satisfactory performance Wing Blowers have been delivering for over half-a-century—plus many superior features of Wing design, such as the volume control (Voltrol) vanes, permitting capacity regulation down to 10% of maximum. Write for complete details and latest bulletin.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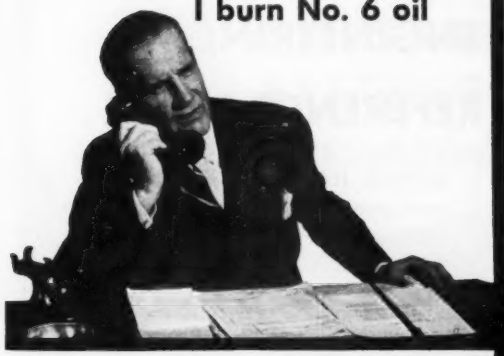
**I burn No. 6 oil**



2.

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3.

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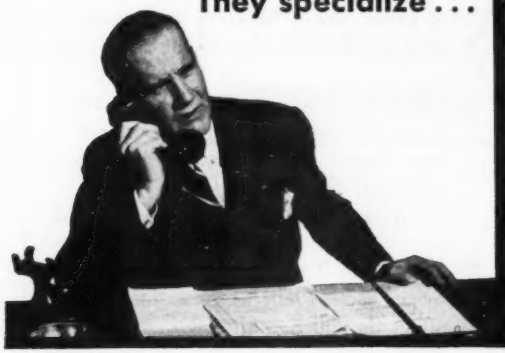


4.

**. . . in fully* automatic operation with residual fuels!**

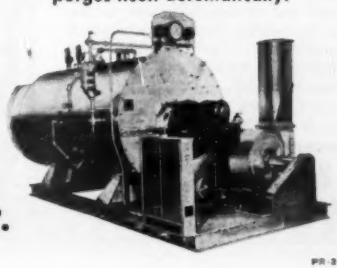
That plant engineer is only one of hundreds who label us specialists in *fully* automatic operation with residual oils. We're proud of the title, of course, for we achieved what many folks said couldn't be done. But, actually, we at Preferred like to be thought of as all-around experts in combustion problems. Witness the complete Preferred line of gas, combination oil-and-gas and light oil-fired steam generators.

We tackled and solved the problem of residual oils, because we knew we could cut your production costs by $3,000 to $35,000 a year by reducing fuel costs. Scores of Preferred customers have already pocketed these savings. Like the engineer on the 'phone, they are burning No. 6 oil with *fully* *automatic operation.

If you are now using more expensive grades of fuel, discuss your installation with a Preferred representative or write for Bulletin 175 about the Preferred Horizontal Rotary Oil Burner and Bulletin 1000 which describes the Preferred Unit Steam Generator.

*What We Mean By *Fully Automatic* Operation

- Starts *automatically*
- Ignites *automatically*
- Starts at low fire and follows load *automatically*
- Shuts off, cleans and purges itself *automatically*.



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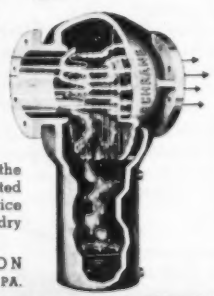
Where exhaust steam is used for heating and deaerating feed water, the oil usually present in the exhaust may be practically eliminated by installing a Cochrane All-Service Separator on the inlet pipe. Clean dry steam is assured.



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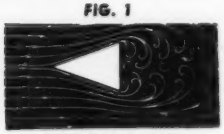
## CASH STANDARD *Streamlined* TYPE 1000 PRESSURE REDUCING VALVES

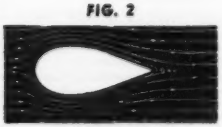
THE "Type 1000" Valve gives users absolute control of pressures. The reduced pressure is held constant regardless of variations in the initial pressure or variations in demand.

FIG. 1



YOU DON'T GET THIS TURBULENCE

FIG. 2



YOU GET THIS STREAMLINED FLOW

This operating feature eliminates all chance of changes occurring in the processing or of damage to product.

When there is peak demand to be met, your "1000" Valve is easily able to do it, holding the pressure constant at the same time.

There is no downstream turbulence in your "1000" Valve. (See Fig. 1). The flow of steam, air, oil, etc. is streamlined (see Fig. 2) for straight flow through the delivery passage and jet. All of the process of pressure reduction occurs where the valve throttles flow and not on the downstream side of the valve. That is one of the feature results of streamlining. Therefore, there is no downstream turbulence and you have close delivery pressure control at all times.

*Write for Bulletin "1000"*

CASH STANDARD CONTROLS . . VALVES

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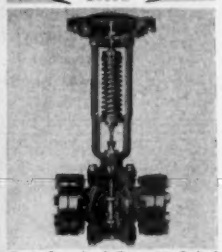
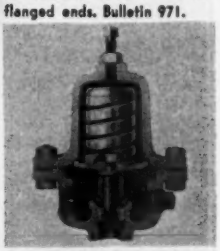
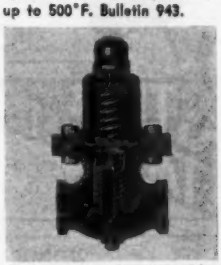
## OTHER VALVES *from the* CASH STANDARD LINE



Cash Standard Type 33 Relief Valve; in various metals to handle nearly all fluids. Has Roller guides on valve spindle; also roller bearing to take care of spring torsion. Sizes ½" to 3" screwed ends; 1" to 12" flanged ends. Bulletin 971.



Cash Standard Type Q Relief Valve has side inlet, bottom outlet. Popular for pump by-pass use. Sizes ½" to 2" screwed ends. Relief pressures up to 350 lbs., temperatures up to 500°F. Bulletin 943.



Cash Standard Type 4190 Valve for relief (bypass) use; holds constant valve inlet pressure regardless of changes in load or outlet pressure. Multiport—large capacity. Iron or bronze bodies; iron or bronze trim. Sizes ½" to 2" screwed ends; 2" to 6" flanged ends. Bulletin 952.

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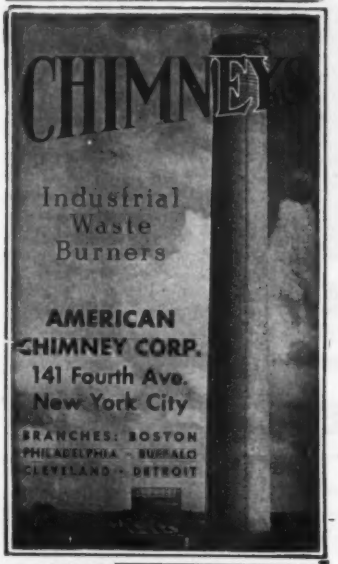


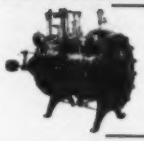

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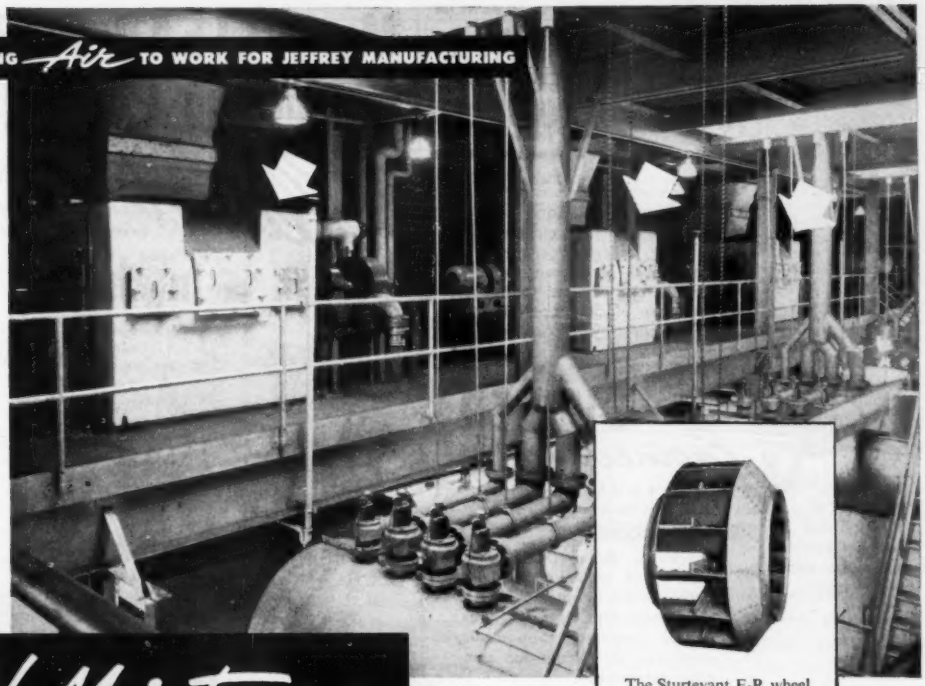



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**YOU CAN BE SURE... IF IT'S Westinghouse**

PUTTING *Air* TO WORK

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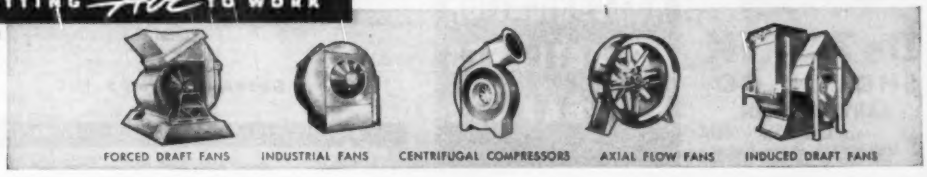

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**FYR-FEEDERS** burn cheaper sizes of coal, wood chips, sawdust, hogged wood, etc., and PAY FOR THEMSELVES quickly. Average annual SAVINGS run from $24 to $90 per rated boiler horsepower. Wet coal is no problem.

**FYR-FEEDERS** replace underfeed coal stokers, spreader stokers, pulverized coal burners, oil and gas burners. Coal savings run from 25% to 75%.

**FYR-FEEDER Spray-Spred Stoker** equipment is sold for Cash or on FYR-FEEDER Coal Savings Purchase Plan . . . no capital investment required . . . all payments **out of actual savings as made.**

Salesmen who sell only 24 average size FYR-FEEDERS annually will earn $15,000 per year in commissions. On 48 sales per year, commissions will run more than $40,000. No investment by salesmen required, but must have car.

Additional commissions can be made by selling our FLO-MATIC (bin to boiler) Wood or Coal Conveyors which are a necessity in every boiler room to conserve manpower.

***If qualified, we will train you in Chicago. For interview, phone SUperior 7-3264, or write—***

**American Coal Burner Company**
***18-R East Erie Street • Chicago, Ill.***


*REPLIES (Box No.):*
*Address to office nearest you*
*NEW YORK: 330 W. 42 St. (18)*
*CHICAGO: 520 N. Michigan Ave. (11)*
*SAN FRANCISCO: 68 Post St. (4)*

### POSITIONS VACANT

ASSISTANT SUPERINTENDENT for central heating plant. State age, salary, and full details in first letter. Send sample of writing. Address: University Engineer, c/o Department of Building & Grounds, University of Idaho, Moscow, Idaho.

GRADUATE MECHANICAL Engineer. Excellent opportunity for auxiliary steam turbine designer to take charge of design department, after he has become familiar with our design. Let us have your resume. State age—experience—qualifications and salary expected. P-1252, Power.

WANTED BY American Mining Engineering Firm, an experienced Electrical Engineer with Administrative experience or retired Utility executive familiar with construction and Power generation for work in large European city. Excellent salary, living allowance, and travel expenses for family. Two-year contract. P-1349, Power.

MECHANICAL GRADUATE preferably licensed —with broad background of Plant engineering, including design of buildings and auxiliary equipment, plant maintenance, power plant design and operation. Paper mill experience helpful. Location Akron, Ohio, with nationally known manufacturer producing variety of products. Salary open. Address P-1380, Power.

STEAM POWER Plant Engr. with stationary or marine experience (operation and maintenance), for public utility in Central America. Write education, experience and salary expected. P-1412, Power.

### EMPLOYMENT SERVICES

SALARIED POSITIONS $3,500 to $25,000. We offer the original personal employment service (established 41 years). Procedure of highest ethical standards is individualized to your personal requirements. Identity covered; present position protected. Ask for particulars. R. W. Bixby, Inc. 270 Dun Bldg., Buffalo 2, N. Y.

*(Continued on page 260)*


## BOILER DRAFTSMEN and DESIGNERS

**SPRINGFIELD BOILER CO., 1953 East Capitol Avenue, Springfield, Illinois, is located right in the center of the U.S.A. food producing area. Springfield is *not* near large industrial war equipment producing areas. Your family will enjoy ideal living conditions and, particularly, the fine temperate climate. Springfield has a large lake—for boating, swimming and fishing.**

**Now we are expanding our activities in the boiler manufacturing field and must increase our engineering and drafting force. We need boiler draftsmen and designers for permanent employment—experienced in heavy and light plate work, structural steel, pressure vessels, piping and similar work.**

**Our employer-employee relations are excellent. People live peacefully here in the center of the prairie state and are friendly and neighborly.**

**MAY WE HAVE YOUR APPLICATION?**

# SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT: BUSINESS: **"OPPORTUNITIES"** EQUIPMENT USED OR RESALE

## KAISER ALUMINUM AND CHEMICAL CORPORATION

★ ★ ★

Steam Power Plant Superintendent. M.E. Degree. 35-40. Full charge of operation and maintenance of boilers and turbines. Large new plant furnishing AC and DC for Aluminum reduction in New Orleans, Louisiana. Knowledge of Diesel electric generating plant desirable but not essential. Salary open. Reply giving full details of educational background and experience to

**FRANK H. WICKHORST**
**1924 Broadway, Oakland, California**

---

Manufacturer's Representative or Salesman, who has industrial following in State of New York. Wanted to represent a nationally-known firm manufacturing additives for fuel, both solid and liquid. State exact territory covered and other firms represented.

**RW-1264, POWER**
**520 N. Michigan Ave., Chicago 11, Ill.**

---

**Central Hudson Gas & Electric Corporation**
**POWER PLANT TECHNICIAN**

Man with at least high school education and with previous experience qualifying him to service instruments and automatic controls in modern steam power plant located near Newburgh, N. Y. Reply, giving qualifications and experience to:—

Employee Relations Office
Central Hudson Gas & Electric Corporation
South Road, Poughkeepsie, New York

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## EMPLOYMENT SERVICES

(Continued from page 260)

SALARIED PERSONNEL $3,000-$25,000. This confidential service established 1927, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and addreses only for details. Personal consultation invited. Jira Thayer Jennings, Dept. G, 241 Orange St., New Haven, Conn.

## POSITIONS WANTED

POWER PLANT Supervisor—eight years' experience in the operation and maintenance of modern power plant, also some construction and refrigeratio experience. Technical education. Age 30. PW-1283, Power.

POWER HOUSE operating engineer with 27 years experience at operating all power house equipment. Would consider taking charge of small plant or an operator in a larger plant. PW-1051, Power.

## SELLING OPPORTUNITY WANTED

ESTABLISHED SALES Engineering company in Philadelphia territory desires to represent additional product in power plant or process engineering fields. RA-1224, Power.

## PATENTS

**Consult: Z. H .Polachek.**

Reg. Patent Attorney, 1234 Broadway, New York 1, N. Y.

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**ATTENTION—SALES MANAGERS**

A New England Industrial Sales Organization—with Salesmen calling on the Industrial-Marine and Power Industries desires additional lines—Are You Represented in New England? If not, write

**RA-9998, POWER**
**330 W. 42 St., New York 18, N. Y.**

---

**PHILADELPHIA REPRESENTATION**

Manufacturers Agent covering Eastern Pennsylvania, Southern New Jersey and Delaware, contacting chemical, refining and other industrial plants can handle an additional account.

**RA-1279, POWER**
**330 W. 42 St., New York 18, N. Y.**

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**AVAILABLE**
**SALES ENGINEERS**

specializing in combustion equipment—desire additional quality accounts for our expanding organization in St. Louis area.

**RA-1345, POWER**
**520 N. Michigan Ave., Chicago 11, Ill.**

---

New England Boiler Setting Co.
Specialists on
**FIRE BRICK CONSTRUCTION**
Industrial Furnaces
Expert Repairing
*Stephen S. Donoghue*
106 Webster St. Arlington 74, Mass.

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## ADD TO YOUR PROFITS

MANUFACTURERS REPRESENTATIVES AND DEALERS WITH POWER PLANT BACKGROUND

Sell **BORGANA** Remarkable organic treatment for boilers and water systems for prevention of scale and corrosion.

- Unconditionally guaranteed
- Easy to sell
- No daily testing—non technical
- Complete insurance protection
- Nationally advertising
- 20 years proven field use

A FEW SELECT TERRITORIES NOW OPEN

**CHEMICAL DIV. PORTLAND SHINGLE CO.**
**9038 N. Denver Ave. Portland 17, Oregon**

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## HEAVY DUTY ROLLER CHAIN

(Immediate Delivery)

1950 Ft.—2" Pitch triple roller chain Cotter Pin Type—Diamond
1900 Ft.—1½" Pitch double roller chain Cotter Pin Type—Link Belt
2800 Ft.—1½" Pitch single roller chain Cotter Pin Type—Link Belt

*Excellent condition, subject to your inspection. Available in any quantity on a first-come-first-serve basis.*

**WALL ROPE WORKS, INC.**
**Beverly, New Jersey**

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## Surplus & Salvage FOR SALE

1—75 KVA GE Transformer Type H 2070-2300/118-220-440 V.
1—65 KVA GE Transformer Type HR 2070-2300/118-220-440 V.
1—50 KVA WH&E Transformer Style SO23K074, 110-220-240-440 V.
1—25 KVA Wagner Transformer Type HF, 1/60/220/440 V.
1—18 KVA Surges (Dry) Transformer Type 31F, 3/60/440
100—Gearhead Motors, 2 to 5 HP 157 to 480 RPM 3/60/220/440.

**SURPLUS & SALVAGE CO., INC.**
**620 W. 8th Street**
**JAMESTOWN, N. Y.**

---

# R I V E T E R S

Heavy Duty Air and Hydr. Squeezers. All Types and Sizes—Immediate Delivery—Unconditional Guarantee Up to 10 ft. reach and 100 Ton Capacity.

**MONTGOMERY ENGINEERING CO.**
14194 Prairie Detroit 4, Mich. TE 4-2040

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## URGENTLY WANTED

300-Kw., M.G. set with 300-Kw. (or larger) 250-volt D.C. Generator driven by 60-cycle, three phase motor, 2300-volt or 4000-volt synchronous preferred.
500-H.P. 2300/3/60/250-RPM sq. cage motor.
500-Kva., 550/3/60/250-RPM Generator.
2500 to 3750-Kva. 3/60/ transformer 33000 to 4160 or
3—650- to 1250-Kva. 1/60/ transformers 33000 to 2400
300-H.P., 2300/3/60/300-RPM, synchronous motor.
500-HP., 550/3/60/257-RPM synchronous motor.
300-H.P., 440/3/60/300-RPM synchronous motor.
150-H.P., 440/3/25/750-RPM squirrel cage motor.
20-H.P., 550/3/60/600 totally enclosed, sq. cage motor.
15-H.P., 220/3/60/600-RPM totally enclosed, sq. cage or slip ring.
4000-Kva., 2300/3/60 steam turbine, gen. set 600-lbs 825 degrees.
75 steel lockers, approx. 12"x15"x60".
250-H.P., 2300/3/60/450-RPM slip ring.
20-30-H.P., 440/3/60 slip ring.
400-H.P., 2300/3/60/600-RPM sq. cage motor.

Please telegraph rush if you can help us locate any of the above machines, which are badly needed.

We have been selling electric and power machinery here over 40 years. We have a large connection and frequently find outlets for equipment that would be slow moving elsewhere. Please send your surplus lists.

We carry a large stock and have developed a huge list of idle machines, many that have never been used. Please send your enquiries.

**SOUL CLINIC INC.**
**Calgary, Alberta, Canada**

---

## Wanted Immediately

One (1) Gantry Crane—30 tons capacity, approximately 40 ft. span, 25 ft. lift, preferably 220 or 440 volt AC, 60 cycle drives.

**DENVER & RIO GRANDE WESTERN RAILROAD**
**1531 Stout St., Denver, Colorado**
Office of the Chief Engineer

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## Air Compressors Wanted

Horizontal Water Cooled—Any size
also 2 Stage portable unit

**L. W. BAUER**
**North Bergen, N. J.**

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**WANTED TO BUY — *For Cash***
**YOUR SURPLUS**
ELECTRIC MOTORS • MOTORS STARTERS
OIL & AIR CIRCUIT BREAKERS • CABLE-WIRING MATERIALS • PANEL BOARD FITTINGS • SPEED REDUCERS
COPPER WIRE
**INDUSTRIAL ELECTRIC & SUPPLY CO., INC.**
**37-1681—Memphis, Tenn.—Box 1398**

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**BUYERS OF SURPLUS COPPER INSULATED WIRES AND CABLES**

No lengths too long or too short
TELEPHONE: EASTGATE 7-4778

**PIERCE CABLE CO.**
2668 CLYBOURN AVE., CHICAGO 14, ILLINOIS

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**WANTED**

100—HP. Low Pressure Boiler. Single or Double Head 2½" Landis Bolt Threader with Lead Screw. Older Model Cincinnati #3 Vertical Miller. Coupling Tightening Machine.

PHONE or WRITE **S. B. DUNNE**
P. O. Box 476, Elizabeth, N. J.
Tel.—ELizabeth 2-8182

ELECTRIC MOTORS AND GENERATORS

# WAGNER CERTIFIED REBUILT WAGNER

BACKED BY 45 YEARS OF QUALITY AND SERVICE

## For QUALITY • SERVICE • PRICE - "Check with WAGNER First!"

**OVER 45 YEARS OF EXPERIENCE is back of every machine sold by Arthur Wagner Company. Large stocks and modern facilities insure ample choice and prompt service at reasonable cost. All Wagner "Certified Rebuilt" equipment conforms to standards approved by National Industrial Service Association. Inspect our shop and stock—see why it pays to . . . "Check with Wagner First!"**

### M-G SETS

| KW | Mfr | Input V | Output V |
|---|---|---|---|
| 500 | Whse.* | 2200/440 AC | 250 DC |
| 300 | Allis Ch. | 2200/440 AC | 125/250 DC |
| 300 | G.E. | 440 AC | 275 DC |
| 200 | Whse.* | 2300 AC | 275 DC |
| 200 | Gen. Elec.* | 220/440 AC | 125 DC |
| 150 | Gen. Elec.* | 2300/440 AC | 600 DC |
| 150 | Cr. Wh.* | 220/440 AC | 250 DC |
| 105 | Century b.b. | 220/440 AC | 70 DC |
| 100 | Allis Ch.* (2) | 2200/440 AC | 60 DC |
| 100 | Whse. | 230 DC | 230 AC |
| 100 | Whse. | 220/440 AC | 230 DC |
| 100 | Gen. Elec. | 220/440 AC | 125 DC |
| 100 | Gen. Elec. | 220/440 AC | 250 DC |
| 75 | Gen. Elec. (2) | 220/440 AC | 250 DC |
| 75 | Gen. Elec. (3) | 220/440 AC | 125 DC |
| 65 | Whse. | 220/440 AC | 250 DC |
| 60 | Gen. Elec.* | 220/440 AC | 60 DC |
| 50 | Allis Ch. (2) | 220/440 AC | 125/250 DC |
| 50 | Gen. Elec. | 220/440 AC | 250 DC |
| 45 | Cr. Wh. b.b. | 220/440 AC | 125 DC |
| 40 | Whse. (2) | 220/440 AC | 125 DC |
| 40 | G.E. | 220/440 AC | 250 DC |
| 35 | Cr. Wh. b.b. | 220/440 AC | 125 DC |
| 35 | G.E. | 220/440 AC | 48 DC |
| 25 | Gen. Elec. | 220/440 AC | 250 DC |
| 25 | G.E. b.b. New | 220/440 AC | 125 DC |

*Syn. motor drive.

### D.C. MOTORS

| HP | Mfr | Type | Volts | Speed |
|---|---|---|---|---|
| 200 | Gen. Elec. | CD189A | 230 | 400/1200 |
| 150 | Cr. Wh. TEFC | 83H | 230 | 800 |
| 100 | Whse. | 8K181 | 230 | 450/900 |
| 100 | Gen. Elec. | C | 230 | 575/1000 |
| 100 | Gen. Elec. | CD125 | 230 | 850 |
| 75 | Whse (2) | 8K163 | 230 | 850 |
| 75 | Gen. Elec. | BC | 230 | 1000 |
| 75 | Northw'n | K20 | 230 | 1750 |
| 60 | Cr. Wh. | 56H | 230 | 700 |
| 60 | Reliance b.b. | 651T | 230 | 750 |
| 50 | Gen. Elec. | LC | 115 | 400/800 |
| 50 | Cr. Wheeler | CMC | 230 | 1750 |
| 50 | Gen. Elec. | B.C. 14 | 250 | 1050 |
| 40/60 | Whse. | 8K160 | 230 | 500/1000 |
| 40 | Gen. Elec. | BC-32 | 230 | 1150 |
| 40 | Cr. Wheeler | EH | 230 | 1750 |
| 40 | Whse. | 8K110L | 230 | 1750 |
| 40 | Whse (2) | 8K130 | 230 | 950 |
| 35/50 | Gen. Elec. | CD123 | 230 | 575/1150 |
| 30 | Whse. | 8K110L | 230 | 1150 |
| 25/30 | Cr. Wh. b.b. | FH | 230 | 575/1725 |
| 25 | Whse. | 8K150 | 230 | 300/1200 |
| 25 | G.E. (2) | CD93 | 230 | 1150 |
| 25 | G.E. b.b. New | CDM93 | 115 | 1150 |
| 25 | Century b.b. | DN | 230 | 1150 |
| 25 | Gen. Elec. | RP13 | 230 | 250/1000 |
| 25 | Gen. Elec. | CD105 | 230 | 500/1500 |
| 20 | Gen. Elec. (2) | CD81 | 230 | 1750 |
| 20 | Whse. (2) | 8K113 | 230 | 500/1500 |
| 20 | Gen. Elec. | BC31B | 230 | 1200 |
| 20 | Gen. Elec. | RP12 | 230 | 400/1600 |

- EXPLOSION PROOF MOTORS—
- GEARHEAD MOTORS, AC & DC.
- FREQUENCY CHANGERS.
- CIRCUIT BREAKERS, AC & DC.
- SPEED REDUCERS.

### D. C. GENERATORS

| KW | Mfr | Type | Volts | Speed |
|---|---|---|---|---|
| 300 | Allis Ch. New | MKCW | 125/250 | 1200 |
| 200 | Gen. Elec. 1 brg. | DMC | 275 | 720 |
| 150 | Cr. Wh. b.b. | 83H | 250 | 1150 |
| 105 | Century b.b. | 1500 amp | 70 | 1200 |
| 100 | Gen. Elec. | CD | 250 | 1200 |
| 100 | Gen. Elec. | C | 250 | 750 |
| 100 | Gen. Elec. | DLC | 125/250 | 675 |
| 75 | Gen. Elec. | BC | 250 | 1200 |
| 75 | Gen. Elec. | BC26 | 125 | 1200 |
| 65 | Whse. | 8K160 | 250 | 1100 |
| 60 | Gen. Elec. | LC | 250 | 700 |
| 50 | Allis Ch. (2) | KW | 125/250 | 1200 |
| 50 | Gen. Elec. | B.C. 14 | 250 | 1200 |
| 50 | Cr. Wheeler | 56H | 250 | 900 |
| 45 | Cr. Wh. b.b. | FH | 125 | 1750 |
| 40 | Whse. | 8K | 250 | 1200 |
| 35 | Gen. Elec. | CD | 230 | 1500 |
| 25 | G.E. b.b. New | CDM93 | 125 | 1450 |

### A. C. GENERATORS — 60 CYCLE

| KVA | Mfr | Type | Volts | Speed |
|---|---|---|---|---|
| 625 | Gen. Elec. | ATB | 2300 | 450 |
| 625 | G.E. 25 cycle | ATB | 2300 | 750 |
| 500 | Allis Ch. | 3 brg. | 240/480 | 360 |
| 300 | Gen. Elec. | ATB | 600 | 720 |
| 275 | G.E. 25 cycle | ATI | 480 | 750 |
| 250 | Whse. | G | 2400/480 | 600 |
| 225 | Gen. Elec. | ATB | 240/480 | 600 |
| 156 | Elec. Machy. | 3 brg. | 240/480 | 514 |
| 125 | Gen Elec. | ATB | 240/480 | 750 |
| 125 | Gen Elec. | ATB | 240/480 | 300 |
| 90 | Gen Elec. | ATI | 240/480 | 1200 |
| 75 | El. Machy. | | 2300 | 900 |
| 75 | Gen. Elec. | ATI | 240/480 | 1200 |
| 56 | Gen. Elec. | ATB | 240/480 | 1200 |
| 56 | Gen. Elec. | ATB | 240/480 | 900 |
| 31 | Whse. b.b. | late | 120/208 | 1200 |

### A. C. MOTORS — SLIP RING
### 3 Phase 60 Cycle 220 or 440 Volts

| QU | HP | Mfr | Type | Speed |
|---|---|---|---|---|
| 1— | 600 | Gen. Elec. | I-M | 360 |
| 1— | 500 | G.E. 3 brg. | I-M | 450 |
| 1— | 400 | Gen. Elec. | I-M | 514 |
| 1— | 350 | Whse. 2200V. | CW | 450 |
| 1— | 300 | G.E. 2300V. | I-M | 1800 |
| 1— | 200 | Whse. 2200V. | CW | 600 |

| | | | | |
|---|---|---|---|---|
| 1— | 250 | G.E. 2300V. | IM-17A | 600 |
| 1— | 250 | Allis Ch. 2200V. | ANY | 514 |
| 1— | 250 | Cr. Wheeler | SR | 600 |
| 1— | 200 | Cr. Wheeler | SR | 600 |
| 1— | 200 | Gen. Elec. | I-M | 360 |
| 2— | 200 | Gen. Elec. | I-M | 600 |
| 1— | 200 | Whse. | CW | 514 |
| 1— | 150 | G.E. 2300/4400V. Vert. | I-M | 1200 |
| 1— | 158 | Gen. Elec. | I-M-17 | 450 |
| 1— | 150 | G.E. | IM-16 | 600 |
| 1— | 125 | G.E. New | M-6333 | 900 |
| 1— | 125 | G.E. New b.b. | M-6325 | 1200 |
| 2— | 100 | G.E. New | M-6324 | 1200 |
| 2— | 100 | Gen. Elec. | I-M | 1800 |
| 1— | 100 | G.E. Vertical | MT352 | 1200 |
| 1— | 100 | Cr. Wheeler | SR | 600 |
| 1— | 100 | Northwestern | HW | 1800 |
| 2— | 75 | Gen. Elec. | MT352 | 900 |
| 1— | 75 | G.E. 2200V. | MT350 | 720 |
| 1— | 75 | Whse. 2200V. | CW | 600 |
| 2— | 75 | Gen. Elec. | MT343 | 1800 |
| 1— | 60 | G.E. TEFC b.b. | M-6326 | 720 |
| 1— | 60 | Fair. Morse | BV | 720 |
| 1— | 60 | Whse. 2200V. | CW716C | 900 |
| 1— | 50 | Allis Ch. | ANY | 900 |
| 1— | 50 | Howell | SR437 | 1200 |
| 1— | 50 | Gen. Elec. Int. | TTC5613 | 600 |
| 2— | 40 | Whse. | CW636A | 1200 |
| 2— | 30 | G.E. 2200V. | MT332 | 900 |
| 1— | 30 | Gen. Elec. | MT332 | 1200 |
| 2— | 30 | Gen. Elec. | MT332 | 900 |
| 2— | 25 | Gen. Elec. | MT | 900 |
| 2— | 20 | Whse. b.b. New | CW284 | 1800 |

### A. C. MOTORS — SYNCHRONOUS

| HP | Mfr | Type | Volts | Speed |
|---|---|---|---|---|
| 600 | Gen. Elec. (2) | TS | 2200 | 514 |
| 300 | Gen. Elec. | ATI | 2300/550 | 450 |
| 300 | Whse. | G | 2200/440 | 600 |
| 300 | Gen. Elec. | ATI | 440 | 720 |
| 275 | G.E. 25 cycle | | 220/440 | 750 |
| 250 | G.E. 3 brg. .8PF | ATI | 220/440 | 600 |
| 250 | Gen. Elec. | TS | 220/440 | 900 |
| 200 | G.E. | TS | 220/440 | 150 |
| 190 | El. Machy. | 3 brg. | 220/440 | 514 |
| 175 | Whse. | 2 brg. | 220/440 | 900 |
| 150 | Gen. Elec. | ATI | 220/440 | 720 |
| 150 | Gen. Elec. | ATI | 220/440 | 300 |
| 125 | El. Machy. (2) | | 220/440 | 1800 |
| 130 | Burke b.b. .8PF | AC10 | 2300/440 | 1200 |
| 125 | El. Machy. | B.B. | 2400/4800 | 900 |
| 100 | American b.b. | YGH | 220/440 | 900 |
| 90 | Gen. Elec. | TS | 220/440 | 1200 |

### A. C. MOTORS — SQUIRREL CAGE
### 3 Phase 60 Cycle 220 or 440 Volts

| QU | HP | Mfr | Type | Speed |
|---|---|---|---|---|
| 2— | 500 | Fair. Morse 2200V. | HS | 1200 |
| 1— | 325 | Gen. Elec. | KT429 | 450 |
| 1— | 300 | G.E. 2200V. | KTP561 | 1800 |
| 1— | 300 | Gen. Elec. | I-K | 600 |
| 1— | 250 | Whse. 2200V. | CS | 1200 |
| 1— | 250 | Gen. Elec. | FT549AZ | 3600 |
| 1— | 250 | Gen. Elec. | IK-17A | 450 |
| 1— | 250 | Gen. Elec. | IK-17 | 600 |
| 1— | 250 | Gen. Elec. | I-K | 720 |
| 1— | 200 | Gen. Elec. | IK-17 | 514 |
| 2— | 200 | Reliance b.b. New | B60858 | 1800 |
| 2— | 200 | Gen. Elec. | I-K | 600 |
| 1— | 200 | G.E. 3 brg. | I-K | 450 |
| 1— | 200/112 | G.E. | KF559 | 1200/900 |
| 1— | 150 | Ideal 2200V. | A-327 | 1800 |
| 1— | 150 | Gen. Elec. TEFC b.b. | K63338 | 1200 |
| 1— | 150 | Gen. Elec. 2200V. | IK-813A | 1200 |
| 1— | 150 | Gen. Elec. | IK-17 | 450 |
| 1— | 150 | G.E. TEFC | K6326 | 3600 |
| 1— | 150 | Whse. | CS | 720 |
| 2— | 125 | Rel. TEFC New | B60838 | 1800 |
| 1— | 125 | G.E. b.b. New | K63248 | 1200 |
| 1— | 125 | Whse. | CS | 900 |
| 2— | 125 | G.E. New b.b. HT | KG6324 | 1200 |
| 1— | 125 | Con. 2200V. b.b. | 8C | 1800 |
| 1— | 125 | F.M. 2200V. vertical | UH-16D | 1200 |
| 1— | 125 | G.E. 2300V. TEFC | K6326 | 3600 |
| 2— | 125 | Reliance b.b. New | 5058 | 1800 |
| 2— | 100 | Gen. Elec. | KT356 | 900 |
| 1— | 100 | Gen. Elec. | I-K | 1200 |
| 1— | 100 | Gen. Elec. | I-K | 720 |
| 1— | 100 | Gen. Elec. b.b. NEW | K5048 | 1800 |
| 2— | 100 | Whse. | CS | 720 |
| 1— | 100 | Rel. TEFC New | 5058 | 3600 |
| 1— | 75 | Rel. TEFC New | 5048 | 3600 |
| 1— | 75/90 | Gen. Elec. | I-K | 3600 |
| 1— | 75 | Wagner | 22VRM | 1200 |
| 1— | 75 | Reliance b.b. HT | 5684 | 1200 |
| 2— | 75 | Whse. | CS | 720 |
| 1— | 75 | Fair. Morse b.b. | BJG | 600 |
| 1— | 75 | Reliance b.b. NEW | C5084 | 900 |
| 2— | 75 | Reliance b.b. NEW | C505 | 1800 |
| 1— | 75 | G.E. TEFC 2200V. | K-6325 | 900 |
| 2— | 75 | Gen. Elec. | KT543 | 1200 |
| 2— | 75 | Gen. Elec. | I-K-14 | 600 |
| 1— | 75 | G.E. Expl. Pf. | K6325 | 1200 |
| 2— | 60 | Gen. Elec. | KT546 | 900 |
| 1— | 60 | Gen. Elec. | KT536 | 450 |
| 1— | 60 | Reliance b.b. New | CC505 | 900 |
| 2— | 60 | G.E. Vertical | KT538 | 1200 |
| 1— | 60 | Gen. Elec. | I-K | 600 |
| 1— | 60 | Reliance TEFC NEW | KT533 | 1800 |
| 1— | 60 | G.E. hi torq | KG504 | 1200 |
| 2— | 60 | Reliance b.b. NEW | B503 | 1800 |
| 1— | 60 | Reliance TEFC NEW | C505 | 1200 |
| 2— | 50 | Gen. Elec. | KT546 | 720 |
| 2— | 50 | G.E. Vertical | KT546 | 720 |
| 2— | 50 | Reliance b.b. New | CC504U | 900 |
| 2— | 50 | Whse. | CS | 1200 |
| 2— | 50 | Reliance b.b. NEW | C445 | 1200 |
| 1— | 50 | Whse. Hollp | WL607 | 900 |
| 1— | 50 | Fair. Morse b.b. | BJ-12D | 900 |
| 2— | 50 | Gen. Elec. | KT527 | 1800 |
| 1— | 40 | Louis Allis b.b. | OX404 | 3600 |
| 2— | 40 | Gen. Elec. | KT533 | 1200 |
| 2— | 40 | Gen. Elec. | KT536 | 900 |
| 2— | 40 | Gen. Elec. | KT346 | 600 |
| 1— | 40 | Whse. b.b. | CS-04 | 1200/900 |
| 2— | 40 | Reliance t. b. New | CB404 | 1800 |
| 1— | 40 | Rel. b.b. 550 V. | C444 | 1800 |

### A. C. MOTORS — 25 CYCLE

| HP | Mfr | Type | Volts | Speed |
|---|---|---|---|---|
| 275 | G.E. synch. | ATI | 440 | 750 |
| 150 | Whse. | HF | 440 | 600 |
| 60 | Allis Ch. | ARY | 440 | 1500 |
| 50 | Gen. Elec. Int. | MTC5337 | 440 | 750 |
| 50 | Gen. Elec. | I-K | 440 | 750 |
| 30 | Gen. Elec. | MT343 | 440 | 750 |
| 25 | Howell | SR | 440 | 750 |

**Arthur Wagner Co.**

1435 W. RANDOLPH ST. MOnroe 6-7409 CHICAGO 7, ILLINOIS

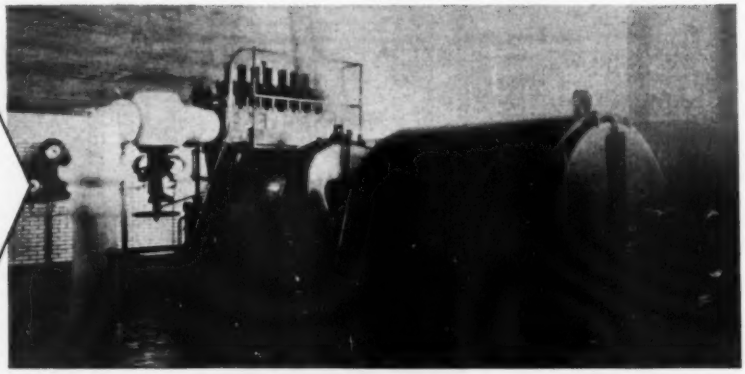
**QUICK SHIPMENT FROM STOCK—LOW PRICES — FULL GUARANTEE**

*Send for Complete Stock Lists*

# POWER for

## Don't wait 18 months or more for the Power We can give you prompt delivery on Complete

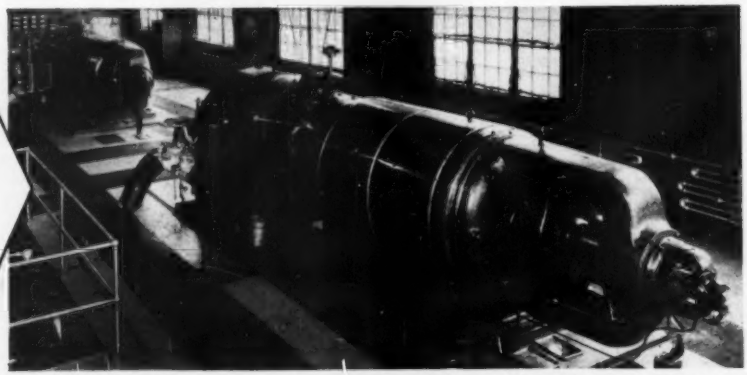
SEND TODAY for BULLETIN 415 Complete Specs.



### 5000 KW-G.E. TURBINE GENERATOR

General Electric Condensing, 225# psig., 3/60/2300/4160-volt. Very complete Unit. Condition, good. Deliver DUTY FREE in Canada and USA.

SEND TODAY for BULLETIN 900 Complete Specs.



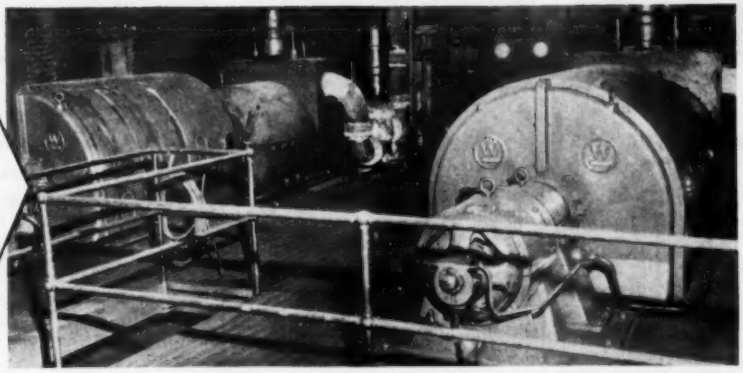
### 2500 KW-G.E. TURBINE GENERATOR

Two (2) 2500-KW., G.E., Condensing, 160/225-psig., 3/60/2300/4160/6900-volt, 450-F.TT, 3600-RPM., Condition A-1. Two Surface Condensers, 2-pass, 6750-sq. ft., with Auxiliaries. Immediate Delivery.

# Production !

## Equipment that you need TODAY!
## Power Units anywhere in U.S. or Canada

SEND TODAY for BULLETIN 405 Complete Specs.



## 40/50# BACK PRESSURE TURBINES

One 2000-KW., Westinghouse, non-condensing, available. 250/350-psig., 550°F.TT., 3/60/2400-volt. Condition, like new, limited service. Immediate Delivery.

**SPECIAL:** 2500-KW., G.E., 850# psig., 825°F.TT., Aut. Extrn., at 150# Condensing. B&W. Boiler, 850# psig., 825°F.TT., complete with pulverized fuel and oil burners. Many other Boilers and Generators 500 to 20,000-KW.

SEND US YOUR SPECIFICATIONS

**OUR SPECIALTIES**

POWER GENERATING EQUIPMENT

TURBO-GENERATORS BOILERS DIESEL POWER

We have in Stock 25 Complete Sets of Turbine-Generators. Capacities 500-KW to 20,000-KW. All Good Units. Boilers, Diesel Power—A Full Line of Both.

***Send Us Your Specifications of Anything Needed***

***JUST ISSUED: OUR 1951 STOCK LIST: Send for it Today: Is FREE***

TELEPHONE. WIRE OR WRITE.

**CHARLES WEAVER, M.E.**

41st FLOOR PENOBSCOT BLDG.
DETROIT 26, MICHIGAN

TELEPHONES
WOODWARD 1-1340
WOODWARD 1-1341
WOODWARD 1-6038

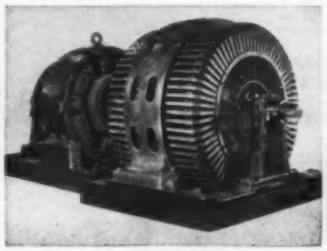
# IT ISN'T RE-NU-BILT UNLESS

## It Comes from

# BELYEA

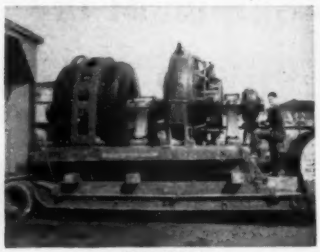
## "SUCCESSFUL OPERATION GUARANTEED"

### Three Recent Stock Arrivals



500 KW-MG

750 KW-MG



2000 KW-MG

### MOTOR GENERATOR SETS

**3 ph. 60 cycle**

| Qu. | KW | Make | Speed | D.C. Volts | A.C. Volts |
|---|---|---|---|---|---|
| 2 | 2000* | G.E. | 500 | | 6600/11000 |
| 1 | 1500 | Whse. | 600 | 600 | 2300/4600 |
| 1 | 1500 | G.E. | 360 | 275 | 2300/4400 |
| 1 | 1400 | Whse. | 360 | 700 | 2300 |
| 1 | 1000 | Whse. | 900 | 600 | 2300/4150 |
| 1 | 1000(3U) | G.E. | 900 | 250 | 2400/4800 |
| 1 | 800 | Whse(3U) | 1200 | 600 | 2300 |
| 1 | 750 | Whse. | 900 | 250 | 2300 |
| 1 | 500 | G.E. | 900 | 600 | 4150 |
| 1 | 500 | Whse. | 900 | 250 | 6600/13200 |
| 1 | 500 | Whse. | 1200 | 125/250 | 2300 |
| 1 | 500 | G.E. | 720 | 125 | 2300/4000 |
| 1 | 400 | G.E. | 720 | 250 | 440/2300 |
| 1 | 400 | Whse. | 1200 | 250 | 2300 |
| 1 | 400 | G.E. | 900 | 275 | 2300/4150 |
| 1 | 250 | G.E. | 900 | 125 | 2300/4150 |
| 1 | 150 | G.E. | 1200 | 120 | 2300 |
| 1 | 150 | Whse. | 1200 | 275 | 2300 |
| 1 | 150 | Cr. Wh. | 1200 | 250 | 440 |
| 1 | 140(3U) | Cr. Wh. | 600 | 125/250 | 2300 |
| 1 | 100 | G.E. | 1170 | 125 | 220 |
| 1 | 100 | Delco | 1200 | 125/250 | 440 |
| 1 | 75 | G.E. | 1200 | 125 | 4000 |
| 1 | 75 | G.E. | 1200 | 250 | 440 |
| 6 | 70 | G.E. | 1200 | 70 | 220/440 |

*25 Cycle

### ROTARY CONVERTERS

**60 Cycles**

| Qu. | KW | Make | Speed | D.C. Volts | A.C. Volts |
|---|---|---|---|---|---|
| 1 | 2000 | G.E. | 514 | 600 | 13800 |
| 1 | 1000 | Whse. | 900 | 600 | 11000 |
| 1 | 750 | Whse. | 900 | 600 | 13200 |

### TURBO GENERATORS

| Qu. | KW | Make | Desc. |
|---|---|---|---|
| 1 | 6000 | Al. Ch. | Condensing 200/250 ISP 2300/3/60-Exc. & Surface Cond. |
| 1 | 2500 | G.E. | Auto. Ext. Cond. 800 lbs.-500* F.T.T. 175/200 Auto. Ext. 2300/3/60 Exciter & Surface Cond. |
| 2 | 1000 | G.E. | Non-condensing, 175/200 lbs. I.S.P. 5/20 lbs G.B.P., 480/3/60. |
| 2 | 750 | G.E. | Condensing 425#-725°TT ISP-440V-3 ph. 60 cy. New — 1944 |
| 1 | 625 | Whse. | Non-condensing, 125/150# ISP 5/20# B.P., 480 v., 3 ph., 60 cy., with exciter |
| 2 | 500 | G.E. | Non-condensing 175/200 lbs. I.S.P., 5/30 G.B.P., 480/3/60. |
| 1 | 400 | Whse. | Non-condensing 125/150# ISP 5/10# BTU 40/480v. 3 ph. 60 cy. |
| 1 | 300 | G.E. | Non-condensing 150/175# ISP 5/15# B.P. 480V. 3 ph. 60 cy. |
| 1 | 300 | Al. Ch. | Condensing 425# ISP Geared to 1200 RPM 120/240V. D.C. |
| 1 | 200 | Whse. | Non-condensing 150# ISP 7# B.P. 240 V. 3 ph. 60 cy. |

### D. C. MOTORS

| HP | Make | Type | Volts | Speed |
|---|---|---|---|---|
| 1—1750 | West. | | 600 | 325/720 |
| 1—1500 | Whse. | | 525 | 525 |
| 1— 940 | Whse. | QM-R.Brg. | 250 | 140/170 |
| 1— 800/1000 | Whse. | | 450 | 650/720 |
| 1— 600 | Al. Ch. | MILL | 230 | 400/800 |
| 2— 450 | Whse. | | 550 | 415 |
| 1— 300/400 | G.E. | DYNA | 250 | 1325/2500 |
| 1— 350 | Cr. Wh. | CCM-151H | 230 | 1100 |
| 1— 325 | Whse. | MQ | 250 | 300/900 |
| 1— 200/300 | G.E. | MPC | 230 | 360/920 |
| 1— 250 | G.E. | MPC | 230 | 400/500 |
| 1— 150 | G.E. | | 600 | 250/750 |
| 10— 150 | Cr. Wh. | 83H | 230 | 890 |
| 1— 150 | Cr. Wh. | CMC-65H | 230 | 1150 |
| 1— 150 | Whse. | SK-201 | 230 | 360/950 |
| 1— 50/120 | G.E. | MCF | 230 | 250/1000 |
| 4— 75 | G.E. | TLC-50 | 250 | 850/2500 |

### FREQUENCY CHANGERS

| | | | | |
|---|---|---|---|---|
| 1—1000 | A.C. | 25/33⅓ | | 2300/2300 |
| 1—1000 | G.E. | 25/58 | Cycle | 4400/2300 |
| 1— 500 | A.C. | 25/60 | Cycle | 11000/2300V |

### SYNCHRONOUS CONDENSERS

| Qu. | Kva. | Make | Volts | Speed |
|---|---|---|---|---|
| 1 | 5140 | Whse. | 4130 | 600 |

### TRANSFORMERS

**60 Cycles**

| Qu. | KVA | Make | Type | Ph. | Voltages |
|---|---|---|---|---|---|
| 2 | 4000 | G.E. | HT | 3 | 22000x2300 |
| 3 | 1250 | G.E. | H | 1 | 6600x500 |
| 1 | 1050 | G.E. | WCTH | 3 | 11000x445 |
| 1 | 500 | Whse. | OISC | 1 | 34650x432 |
| 3 | 333 | Maloney | OISC | 1 | 13200x240/480 |
| 6 | 300 | G.E. | HT | 3 | 13200x240/480 |
| 3 | 300 | G.E. | HT | 3 | 6900x240/480 |
| 9 | 300 | G.E. | HT | 3 | 2400x240/480 |
| 3 | 150 | Maloney | OISC | 1 | 13800x2300/4600 |
| 1 | 100 | G.E. | H | 1 | 456x230 |

### RECTIFIERS

| | | | | |
|---|---|---|---|---|
| 1— 750 | G.E. | BHW | 575 | 2300 |
| 1—1000 | A.C. | B-612 | 625 | 13500 |
| 1—1000* | A.B.B. | GRZ | 625 | 6600/13200 |

*This unit with full automatic control good for both 25 and 60 cycle.

### A. C. MOTORS

**3 ph. 60 cycle**

**SYNCHRONOUS**

| HP | Make | Type | Volts | Speed |
|---|---|---|---|---|
| 2—3500 | G.E. | TS | 2300 | 257 |
| 2—2000 | Whse. | | 2300 | 120 |
| 2— 900 | Al. Ch. | (New) | 2200 | 150 |
| 3— 735 | G.E. | ATI | 2200/12000 | 600 |
| 1— 650 | Whse. | G | 2200 | 182 |
| 1— 600 | Whse. | Syn. | 440 | 360 |
| 1— 450 | Whse. | Eng. | 2200 | 128.5 |
| 2— 350 | G.E. | TS | 2200 | 150 |
| 1— 300 | Whse. | | 2200 | 720 |
| 1— 300 | Whse. | G | 440 | 900 |
| 1— 125 | G.E. | ATI | 440 | 450 |
| 1— 100 | Whse. | | 550 | 600 |

**SLIP RING**

| | | | | |
|---|---|---|---|---|
| 1—1000 | Whse. | CW | 2300 | 444 |
| 2— 500 | G.E.unused | M-574Y | 2200 | 900 |
| 1— 500 | G.E. | IP | 550 | 505 |
| 1— 500 | G.E. | IM-Mill | 2300 | 450 |
| 1— 500 | G.E. | IM | 440 | 900 |
| 1— 350 | G.E. | MT-442-Y | 2200/4000 | 253 |
| 1— 300 | Al. Ch. | 3 Brg. | 2300 | 505 |
| 1— 300 | G.E. | IM | 440 | 720 |
| 1— 300 | Al. Chal. | ANY | 2200 | 705 |
| 1— 250 | Al. Chal. | ANY | 440 | 585 |
| 1— 250 | G.E. | M-567-TEFC | 440 | 600 |
| 1— 250 | G.E. | MT-424Y | 4000 | 257 |
| 1— 250 | G.E. | MT-559S | 2200 | 1750 |
| 1— 250 | Al. Chal. | ANY | 550 | 600 |
| 1— 200 | Al. Ch. | ANY | 440 | 440 |
| 1— 200 | G.E. | MTF | 440 | 1170 |
| 1— 150 | G.E. | IM-15 | 440 | 695 |
| 1— 150 | Al. Chal. | ANY | 440 | 580 |
| 4— 125 | G.E. | MT-566Y | 440/2200 | 435 |
| 4— 100 | G.E. | MT-566Y | 440/2200 | 425 |
| 1— 100 | G.E. | IM-16 | 2200 | 435 |
| 2— 100 | G.E. | IM | 440 | 600 |
| 3— 100 | Al. Ch. | ANY | 440 | 695 |
| 1— 100 | G.E. | MT-556 | 2200 | 900 |

**SQUIRREL CAGE**

| | | | | |
|---|---|---|---|---|
| 2— 650 | G.E. | FT5503Y | 440 | 3570 |
| 2— 450 | Whse. | CR | 2300/4150 | 354 |
| 1— 300 | G.E. | IK-17 | 440 | 580 |
| 1— 200 | G.E. | KT-557 | 440 | 1800 |
| 1— 300 | G.E. | KT-571Y | 2300 | 505 |
| 1— 200 | G.E. | IK-17 | 440 | 580 |
| 1— 150 | Wstghse. | CS856S | 440 | 850 |
| 1— 125 | Whse. | MS | 440 | 485 |
| 1— 125 | (New) G.E. | KP-TEFC | 440 | 1190 |
| 1— 125 | G.E. | KP-TEFC | 440 | 3585 |
| 3— 125 | Al. Ch. | ARW | 2200 | 1750 |
| 1— 125 | G.E. | IK | 220 | 900 |
| 1— 100 | G.E. | IK-Vert. | 2300 | 450 |
| 2— 100 | G.E. | KT-515 | 220/440 | 1750 |
| 1— 100 | G.E. | KT-556 | 440 | 900 |

RE NU BILT BELYEA MOTORS

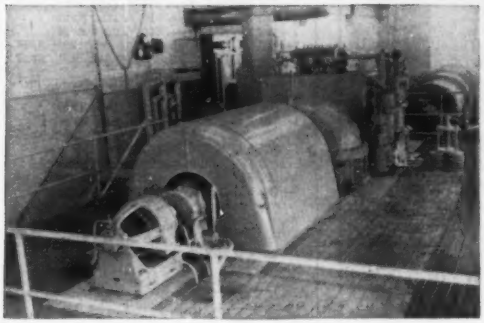
# BELYEA COMPANY, Inc.

**43 HOWELL ST., JERSEY CITY, N. J.**

**PHONE—JOURNAL SQUARE 2-3334**

**N. Y. LINE—RECTOR 2-7150**

# • TURBO GENERATORS •

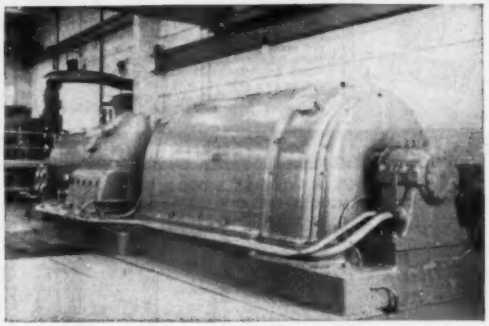


## Actual Photo—2500 KW

**GENERAL ELECTRIC TURBO UNIT**

**TURBO:** 2500 KW, 3600 r.p.m., Form AA, 11 stage, 800 lbs. G. AUTOMATIC EXTRACTION, 2½" abs. condensing.
**GENERATOR:** 2500 KW, 3600 r.p.m., 3125 KVA, 80% p.f., type ATB-2 form T, 3 phase, 60 cycle, 2300 volt.
**EXCITER,** 25 KW, 125 volt, 3600 r.p.m. direct connected. Complete operating panel.
**CONDENSER:** Alberger, surface type, 2 pass, complete with circulating, condensate and air removal pumps.
**WATER RATES:** Calculated at 800 lbs. I.S.P., 750° F.T.T., and 2½" abs.—KW—Lbs. per KW Hr.

| | | | |
|---|---|---|---|
| 3125 KVA | 10.89 | 1875 KW | 11.22 |
| 2500 KW | 10.89 | 1250 KW | 11.92 |



## Actual Photo—6000 KW

**ALLIS CHALMERS TURBO UNIT**

**TURBO:** 6000 KW, 3600 r.p.m., 200/225 lbs. I.S.P., 550° F.T.T., 2½" abs., condensing.

**GENERATOR:** 6000 KW, 3600 r.p.m., 7500 KVA, 80% p.f., 3 phase, 60 cycle, 2300 volt.

**EXCITER:** 50 KW TURBO UNIT, 125 volt complete operating panel.

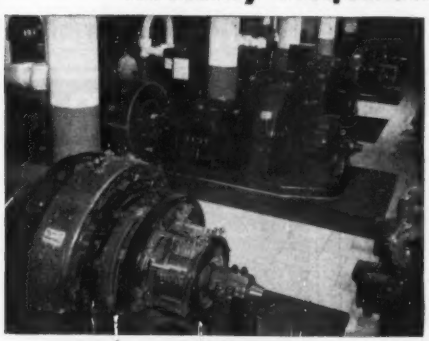
**CONDENSER:** ALLIS-CHALMERS, Surface type, 2 pass, complete with circulating, condensate and air removal pumps.

This installation may be purchased in its entirety or in parts, and we will be pleased to supply additional information upon inquiry. The 2500 KW G.E. Electric Unit served as a topping installation for the 6000 KW Turbo Unit; and associated equipment included one

## • B & W STIRLING BOILER •

100,000 lbs. per. hr., 800 lbs. pressure, 800° F.T.T. complete with pumps, pulverizers, gauges, valves, and standard trim.

## Recently Acquired Geared D.C. Turbo Units



2—1000 KW—G.E.—Non-Condensing 200# ISP—100° S.H.—5/20# B.P. 480/3/60.

1—1000 KW—Moore-GE. Condensing Mixed Pressure—200# ISP—100° S.H. 250V. D.C.

2—500 KW—G.E. Non-Condensing 200# ISP—100° S.H. —5/10# B.P.—250V. D.C.

*Photo at left shows installation can be inspected as shown.*

# BELYEA COMPANY, INC.

**43 HOWELL STREET JERSEY CITY 6, N. J.**

here's the reason...

## . . . YOU CAN FIND EQUIPMENT YOU NEED

*Stocks - on - hand*

Our modern plant houses one of the nation's largest stocks of motors and equipment. Here you will find row upon row of motors, rebuilt and ready for use to meet your requirements. From this complete stock you can be sure that you will find what you need and that it is quality equipment fully guaranteed.

## GUARANTEED REBUILT POWER EQUIPMENT

### HERE'S A WIDE SELECTION FROM OUR GIANT STOCK

#### SQUIRREL CAGE MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2200 volts or higher)

| H.P. | MAKE | TYPE | SPEED |
|---|---|---|---|
| 1000 | *G.E. (New) | K6347B | 1800 |
| 750 | *G.E. | KT | 720 |
| 600 | *A.C. (New) | AZ (TEFC) | 3600 |
| 500 | *G.E. | PBG | 1800 |
| 500 | *Fr.-Morse | HB | 1200 |
| 450 | *G.E. | KF-5675 | 1200 |
| 400 | *Cent. (New) | NZ | 1800 |
| 400 | *A.C. | ARWW | 900 |
| 300 | *Westgh. | CS | 3600 |
| 300 | G.E. | IE-K | 1200 |
| 300 | A.C. | AR | 900 |
| 300 | Westgh. | CS | 514 |
| 250 | West. (New) | CS | 1800 |
| 250 | A.C. (New) | ARW | 900 |
| 250 | L. Allis | 1405 | 720 |
| 250 | Westgh. | CS | 600 |
| 200 | *G.E. | IK-13B | 1800 |
| 150 | G.E. | KT | 1800 |
| 150 | G.E. | KTP | 1200 |
| 150 | G.E. | IE | 1800 |
| 150 | *A.C. (New) | ARW | 1800 |
| 150 | Westgh. | CS8504A | 600 |
| 125 | West. (New) | CS504 | 3600 |
| 125 | *A.C. | AR220 | 1800 |
| 125 | G.E. | K6326B (tefc) | 1200 |
| 125 | A.C. | AR | 600 |
| 125 | G.E. (New) | K6333 | 900 |
| 100 | A.C. (New) | ARWWT | 3600 |
| 100 | *G.E. | FTS42Z | 1800 |
| 100 | G.E. | FTRP | 1800 |
| 100 | *Westgh. | CS | 1800 |
| 100 | U.S. (Vert.) | CFU | 1200 |
| 100 | Westgh. | CS | 1200 |
| 75 | West. (New) | CS5035 | 1800 |
| 75 | G.E. | K505 | 1200 |
| 75 | G.E. | KT346 | 1200 |
| 75 | Ideal | AA350 | 720 |
| 75 | G.E. | FTS36 | 720 |
| 75 | Triumph | TRI6 | 514 |
| 75 | G.E. | IK | 600 |
| 75 | G.E. | IK | 514 |
| 60 | Westgh. | CS504 | 1800 |
| 60 | A.C. (New) | ARB230 | 900 |
| 60 | A.C. | AR626F | 514 |
| 50 | G.E. | KT527 | 1800 |
| 50 | U.S. (Vert.) | SCV037 | 1800 |
| 50 | Westgh. | CS640 | 1200 |
| 50 | Westgh. | CS504 | 1200 |
| 50 | G.E. | KT343 | 1200 |
| 50 | G.E. | KTP | 1200 |
| 50 | *G.E. | KT342 | 900 |

Hundreds of smaller motors!

#### DIRECT CURRENT MOTORS

230 Volts

| H.P. | MAKE | TYPE | SPEED |
|---|---|---|---|
| 1500 | Westgh. | | 300/600 |
| 1000 | Westgh. | | 400/800 |
| 400 | Westgh. | | 600/1200 |
| 375 | Westgh. | Pcd | 650 |
| 200 | Westgh. | SK210 | 800 |
| 175 | Reliance | 5607 | 750 |
| 175 | G.E. | ELC11 | 750 |
| 125 | G.E. | Marine | 1200 |
| 100 | G.E. | RC34 | 2500 |
| 100 | Westgh. | SK175 | 850 |
| 100 | A.C. | E152 | 575 |
| 40 | Cr.-Wh. | CMC | 1750 |
| 40 | G.E. | CO2004 | 900 |
| 35 | Cr.-Wh. | CM351 | 700 |
| 35 | G.E. | C | 600 |
| 30 | Westgh. | SK128 | 975 |
| 30 | Cr.-Wh. | CCM | 650 |
| 30 | Westgh. | SK93 | 1750 |
| 30 | G.E. | RC31B | 1150 |
| 25 | Westgh. | SK113 | 850 |
| 25 | Westgh. | SK106L | 1100 |

MANY OTHERS—1 HP and Up!

#### DIESEL-GENERATORS (2)

NEW—31.25 KVA Rogers AC Generators, 3/60/120/208, d/e Exciter, Driven by direct-coupled Cummins Diesel Engine. Model H-1—Complete Control Panel—NEW

#### HI-PRESSURE PUMPS

| GPM | MAKE | TYPE | HEAD |
|---|---|---|---|
| 800 | Worth | 6DS | 925 ft. |
| 360 | Manistee | H | 750 ft. |
| 300 | Al. Ch. | NMZ | 800 ft. |

#### SLIP RING MOTORS

3 Phase, 60 cycle, 220 or 440 volts (*2200 Volts or higher)

| H.P. | MAKE | TYPE | SPEED |
|---|---|---|---|
| 2000 | *G.E. | MT39 | 240 |
| 1250 | *Cr.-Wh. | | 240 |
| 800 | *A.C. | 3 Brs | 450 |
| 650 | Westgh. | HE | 350 |
| 500 | Westgh. | CW | 350 |
| 400 | G.E. | IM | 450 |
| 300 | *G.E. | IM | 1800 |
| 300 | G.E. | MT | 450 |
| 250 | *G.E. | MT422 | 450 |
| 200 | G.E. | IM | 1800 |
| 150 | G.E. | MT564 | 1800 |
| 150 | West. (New) | C8772C | 1200 |
| 125 | G.E. (New) | M6333 | 900 |
| 125 | G.E. (New) | M6334 | 720 |
| 100 | G.E. | MT543 | 1800 |
| 100 | A.C. | ANY | 900 |
| 100 | Westgh. | CW | 900 |
| 100 | G.E. | IM | 450 |
| 75 | A.C. | | 900 |
| 75 | Star | Q800 | 900 |
| 75 | G.E. | IM-14 | 900 |
| 60 | G.E. (New) | M505 | 1200 |
| 60 | Westgh. | CW | 900 |
| 60 | G.E. | IM11A | 1800 |
| 50 | A.C. | ARV | 1800 |
| 50 | Westgh. | CW | 1200 |
| 50 | G.E. | MT340 | 720 |
| 50 | G.E. | IM | 900 |
| 50 | G.E. | IM14 | 425 |
| 40 | G.E. | MT336 | 1200 |
| 40 | Westgh. | CW544 | 900 |
| 40 | G.E. (New) | M504U | 900 |
| 35 | F.-Morse (V) | UAB | 1800 |
| 35 | G.E. | IM | 1200 |
| 30 | G.E. | MT502 | 900 |
| 30 | Westgh. | CW445 | 900 |
| 25 | G.E. | IM-11 | 1200 |
| 25 | A.C. | ARY220 | 900 |
| 25 | G.E. | IM | 900 |
| 20 | A.C. | ARY210 | 1200 |
| 20 | G.E. | MT512 | 1200 |
| 20 | G.E. | MT322 | 900 |
| 20 | G.E. | IM | 720 |
| 20 | Westgh. | CW544 | 900 |
| 15 | L. All.(New) | GH328 | 1800 |
| 15 | G.E. | IM | 1200 |
| 15 | A.C. | ARY218 | 900 |
| 15 | Ideal | AVE | 900 |
| 10 | Westgh. | CW324 | 1800 |
| 10 | Westgh. | CW385 | 900 |
| 10 | G.E. (380 v) | IM (25 cy.) | 715 |

#### SLIP RING MOTORS

Crane and Hoist Type
N3/60/220 or 440 Volt

| H.P. | MAKE | TYPE | SPEED |
|---|---|---|---|
| 75 | Westgh. | CI756A | 600 |
| 37 | G.E. | HITC (TENV) | 900 |
| 25 | Westgh. | CI572 | 900 |
| 22 | G.E. | ITC5008 | 1200 |
| 20 | Westgh. | CI | 900 |
| 15 | G.E. | ITC5010-25 cy. | 720 |
| 11 | Westgh. | CI464 | 900 |
| 6½ | F. M | 425A (TENV) | 1200 |
| 3 | G.E. | MTC5108 | 1200 |

#### TURBINE SPECIAL

312 KVA Crocker-Wheeler AC Generator 3/60/240/480 volt, d/c 6 to
375 HP Worthington-Moore Turbine, Single Automatic, Non-Condensing, 425 PSI, 10 Hg. Exh., 100° F SH with Reduction Gear and Accessories

#### AC SYNCHRO. GENERATORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2000 volts or higher)

| KVA | MAKE | TYPE | P.F. | Spd. |
|---|---|---|---|---|
| 1500 | G.E. | ATI | .8 | 600 |
| 1060 | *Westgh. | 883D | .8 | 900 |
| 250 | Al-Ch (New) | | .8 | 720 |
| 150 | Ell. Mashy | EM | .8 | 720 |
| 112.5 | *G.E. | ATB | .8 | 1200 |
| 110 | Cr.-Wh | 1305 | .8 | 900 |
| 100 | *G.E. | ATB | .8 | 900 |
| 60 | Fr.-Morse | B | .8 | 900 |
| 35 | G.E. | ATB | .8 | 1200 |
| 50 | G.E. | ATB | .8 | 1200 |
| 50 | Westgh. | | .8 | 1200 |
| 50 | Cr.-Wh | 5068 | .8 | 1200 |
| 37.5 | Al-Ch | EA121 | .8 | 1800 |

#### MOTOR-GENERATOR SETS

| K.W. | MAKE | A.C. | D.C. |
|---|---|---|---|
| 500 | Westgh. | 2300 | 250 |
| 500 | Westgh. | 550 | 250 |
| 500 | Cr.-Wh | 220/440 | 250 |
| 450 | G.E. | 2300 | 125/250 |
| 400 | Westgh. | 2300 | 600 |
| 250 | West.-GE | 440 | 250 |
| 200 | Cr.-Wh | 440 | 250 |
| 200 | Ridgeway | 208 | 250 |
| 150 | G.E. | 2300/440 | 250 |
| 150 | G.E. | 440 | 250/275 |
| 150 | Cr.-Wh | 440 | 250 |
| 150 | Al-Ch | 220 | 125 |
| 100 | G.E. | 440 | 250 |
| 100 | G.E. | 220 | 250 |
| 100 | G.E. | 220 | 250 |
| 100 | G.E. | 220 | 250 |
| 75 | Al-Ch | 440 | 250 |
| 75 | Westgh | 2300 | 115 |
| 60 | Al-Ch | 220 | 118 |
| 40 | Cr.-Wh | 220 | 125 |
| 40 | El-P-GE | 440 | 250 |
| 40 | Al-Ch | 440 | 250 |
| 30 | G.E. | 220 | 125 |
| 25 | G.E. | 440 | 250 |
| 20 | G.E. | 440 | 250 |
| 20 | G.E. | 440 | 125 |
| 10 | Cr.-Wh | 220 | 125 |
| 10 | G.E. | 440 | 250 |

#### D.C. TO A.C.

| | | | |
|---|---|---|---|
| 100 | G.E. | 230 | 230 |

#### BALANCING SETS

34 KW 250 V. 270 A. Neut. Bogue, Type MGL 125 v. Gen. DD, Compl'd. on Fabricated Steel Base, d/e

29 KW. 250 V. 180 A. Neut. Crocker-Wheeler, Type 151, 125 V. Gen. 3 sl. bearings, close-coupled.

#### AIR COMPRESSORS

| SIZE | MAKE | TYPE | DISPL. | PSI. |
|---|---|---|---|---|
| 10 x10 | Ing-R. | ERI | 223 | 125 |
| 10 x8 | Ing-R. | DRI | 179 | 85 |
| 9 x8 | Worth. | HB | 211 | 100 |
| 9 x8 | Ing-R. | ERI | 145 | 100 |
| 8½x9 | Worth. | HB | 170 | 100 |
| 7 x7 | Worth. | HB | 122 | 100 |

#### AC SYNCHRONOUS MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2200 Volts or Higher)

| H.P. | MAKE | Type | P.F. | Speed |
|---|---|---|---|---|
| 800 | G.E. | TS584 | 1.0 | 1800 |
| 750 | *Westgh. | | .8 | 900 |
| 700 | G.E. | TS | | 514 |
| 320 | *A.C. | Dr Pf | 1.0 | 720 |
| 300 | Cr.-Wh. | ENG | 1.0 | 300 |
| 250 | *A.C. | Dr Pf | .8 | 720 |
| 220 | G.E. | ATI | 1.0 | 600 |
| 190 | El. Mashy. | Pcd | 1.0 | 450 |
| 150 | El. Mashy. | EM | .8 | 720 |
| 150 | *Westgh. | | 1.0 | 300 |
| 125 | *El. Mashy. | SYN | 1.0 | 900 |
| 125 | Cr.Wh. | 1805 | 1.0 | 1800 |
| 125 | *G.E. | TS | 1.0 | 277 |
| 115 | El. Mashy. | EM | 1.0 | 240 |
| 100 | Cr.-Wh. | 1305 | .8 | 900 |
| 100 | *G.E. | ATB | .8 | 900 |
| 100 | Ideal | SMS | 1.0 | 900 |
| 75 | G.E. | ATI | 1.0 | 900 |
| 60 | G.E. | TS7536 | 1.0 | 1200 |
| 40 | G.E. | ATB | .8 | 1200 |
| 20 | Fynn-W. | 15VRN | | 1296 |
| 15 | Century | ARC385 | 1.8 | 1200 |
| 4 | G.E. | AK 25 cy | | 1500 |

#### TRANSFORMERS

3—2000 KVA Pittsburgh, 1 phase 12,000 V Primary 2300 V Secondary

6— 750 KVA Westinghouse—AIR— 3 ph., 13,800 V Primary 480 V Secondary

1— 750 KVA Westinghouse—AIR— 3 ph., 13,800 V Primary 2300 V Secondary

3— 667 KVA Niagara, 1 phase 13,000 V Primary 480 V Secondary

3— 300 KVA General Electric, 3 ph. 13,800 V Primary 2400/480 V Secondary

2— 300 KVA General Electric, 3 ph. 2400 V Primary 240/480 V Secondary

6— 187 KVA General Electric, 1 ph. 2300/4160Y V Primary 240/480 V Secondary

*First Source for 41 Years for Quality Electrical Equipment*

**CHICAGO** *Electric Co.*

1320 W. CERMAK ROAD CHICAGO 8, ILL.

#### MOTOR GENERATORS

1—1000 KW G.E. Syn. 250 V. 720 RPM
1—750 KW A-C Syn. 250 V. 720 RPM
2—300 KW G.E. Syn. 250 V. 1200 RPM
1—200 KW G.E. Syn. 250 V. 1200 RPM
1—200 KW G.E. Syn. 600 V. 1200 RPM
2—150 KW G.E. Syn. 250 V. 1200 RPM
1—100 KW G.E. Syn. 250 V. 900 RPM

#### ROTARY CONVERTERS

1—500 KW G.E. Syn. 250 V. 1200 RPM
1—300 KW G.E. Syn. 250 V. 1200 RPM
1—300 KW WEST. Syn. 250 V. 1200 RPM
1—200 KW WEST. Syn. 250 V. 1200 RPM
1—150 KW G.E. Syn. 250 V. 1200 RPM
1—150 KW WEST. Syn. 250 V. 1200 RPM
2—100 KW G.E. Syn. 250 V. 1200 RPM

#### ARMATURES

2—150 KW G.E. Syn. 250 V. 1200 RPM
1—100 KW G.E. Syn. 250 V. 900 RPM

**WALLACE E. KIRK COMPANY**
**502 Grant Bldg., Pittsburgh 19, Pa.**

**AMERICAN**
Famous for Fine
**REBUILTS**
*Since 1902*

**SPECIAL**
136CFM—350# American
670CFM—125# Worthington Duplex
877CFM—125# Ingersoll Duplex

WE SPECIALIZE IN OIL-LESS COMPRESSORS

**RENTAL**
273 AIR COMPRESSORS AVAILABLE
RENTAL PURCHASE
GAS — DIESEL — ELECTRIC

**AMERICAN AIR COMPRESSOR CORP.**
**Dell Ave., & 47th North Bergen, N. J.**

#### MODERN AIR COMPRESSORS

676 FT. WORTHINGTON ELEC.
1302 FT. CHGO. PNEU. V. BELT.
1578 FT. SULLIVAN ELEC.
2400 FT. CHGO. PNEU. ELEC.
2—3000 FT. INGERSOLL RAND ELEC.

**DARIEN, 60 E. 42nd St., N. Y. 17, N.Y.**

**BOILERS**
10 to 1000 H.P.
**NEW-USED**
**RECONDITIONED**
*Steam, Gas and Electric*
*Power Equipment*
J. PARKER THOMPSON CO., INC.
507 FIFTH AVE., NEW YORK CITY
MURRAY HILL 7-0547-8-9

#### 480 HP BUCKEYE

Diesel Engine, 8 Cylinder, 10½" x 12" stroke, 600 RPM, Model 80, late type. Rebuilt.

**ALJON ELECTRIC DIESEL CO.**
904 Pacific Street Brooklyn 16, NY
STerling 3-6515

# LAND can help you meet your Production Schedule with

## *Guaranteed Electrical Equipment*

**1 YEAR GUARANTEE**

**3—750 KVA Westinghouse Single Phase Transformers, Primary 13800/6900/4160/2400 volts—Secondary 460 volts.**
**Ready for Immediate Shipment**

**1 to 50 HP**
**NEW and REBUILT**
TEFC—EX. PR.—Drip proof and Splash proof—Geared Head
**IN STOCK**

### SQUIRREL CAGE MOTORS
**3 phase**

| H.P. | Make | Type | Speed |
|---|---|---|---|
| 200 | G.E. | KT 587 | 1760 |
| 200 | G.E. | KF-6335 | 880 |
| 150 | West. | CS | 580 |
| 150 | G.E. | IK | 870 |
| 150 | West. | CS | 870 |
| 125 | Century (3) | SCN | 1150 |
| 100 | Century (7) | SCN | 1150 |
| 100 | Wagner (2) (NEW) | XP | 1150 |
| 100 | G.E. | K-544 | 1175 |
| 100 | West. | CS | 870 |
| 100 | Al.Ch. | | 690 |
| 75 | West. (2) | CS-654C | 1750 |
| 75 | G.E. (3) | K-505 | 1175 |
| 75 | Cont. (2) | TEFC | 870 |
| 75 | G.E. | IK | 900 |
| 75 | G.E. | KT-352 | 865 |
| 75 | West. | CS | 720 |
| 60 | F-M | TEFC (2) | 1750 |
| 60 | Howell | SCR | 1800 |
| 60 | West. (2) | CS-607 | 880 |
| 60 | Rel. | AA | 875 |
| 60 | G.E. | KT-346 | 865 |
| 60 | G.E. (2) | TEFC(GH) | 427 |
| 50 | G.E. | FTR-525 | 3600 |
| 50 | Elliott | 196 | 3450 |
| 50 | West. | CS | 1740 |
| 50 | West. | XP | 1150 |
| 50 | G.E. | KF-445 | 1170 |
| 50 | West. | CS-642C | 1160 |
| 50 | West. (3) | CS | 870 |
| 50 | G.E. (2) | IK | 870 |
| 50 | G.E. | FTR-542 | 870 |
| 50 | West. | CS | 690 |

### SLIPRING MOTORS
**3 Phase**

| H.P. | Make | Type | Speed |
|---|---|---|---|
| 600 | Cr.Wh. | 131AQ | 507 |
| 500 | G.E. (2) | IM | 450 |
| 500 | Ideal | | 1150 |
| 225 | Wagner | 25 cy. | 710 |
| 200 | G.E. (2) | IM | 1170 |
| 150 | Wagner | 31VRN | 900 |
| 150 | Burke | | 720 |
| 125 | Burke | | 600 |
| 75 | West. | CW | 720 |
| 75 | G.E. | MT556 | 900 |
| 75 | G.E. | IM | 690 |
| 60 | West. | HF | 850 |
| 60 | Al.Ch. | | 690 |
| 50 | G.E. | MT-536 | 1150 |
| 50 | West. | CW | 1150 |
| 50 | L.A. | OGH | 870 |
| 50 | F-M | BV | 600 |
| 50 | Al.Ch. | ARY | 575 |
| 50 | G.E. | IM | 490 |

### SYNCHRONOUS MOTORS

| H.P. | Make | Type | Speed |
|---|---|---|---|
| 475 | West. | | 720 |
| 300 | G.E. | ATI | 900 |
| 260 | G.E. | TS | 900 |
| 200 | West. | Unused | 900 |
| 180 | G.E. | ATI | 900 |
| 150 | G.E. | TS | 720 |
| 150 | G.E. | ATI | 900 |
| 135 | West. | G | 1200 |
| 100 | Elec. Prods. | | 1200 |
| 55 | El.Machry. | BRKT | 1200 |

### 230 V.D.C. MOTORS

| H.P. | Make | Type | Speed |
|---|---|---|---|
| 200 | West. | SK210 | 575 |
| 150 | G.E. | L.C. | 1750 |
| 100 | Al.Ch. | | 1150 |
| 90/45 | G.E. | RF-17 | 950/475 |
| 75 | Sprague | | 1000/1500 |
| 75 | G.E. | RC36 | 800 |
| 75 | West. (2) | SK-180 | 475 |
| 75 | Cr.Wh. | CMC | 375/950 |
| 75 | E-D | 2SS | 450/1350 |
| 75 | West. | SK151 | 250/1000 |
| 60 | West. (3) | SK-160 | 680 |
| 50 | G.E. | RC-12 | 1750 |
| 45/90 | G.E. | RF-17 | 475/1950 |
| 50 | West. (3) | SK-160 | 565 |
| 50 | G.E. | CD | 3600 |
| 50 | G.E. | RF-17 | 250/1000 |
| 50 | West. | SK | 250/1000 |
| 40 | West. | SK-103 | 1750 |
| 40 | Century | DN-454 | 1740 |
| 40 | G.E. | RC-31 | 1700 |
| 40 | G.E. | RC-32 | 1100 |
| 40 | G.E. | RC-34 | 750 |
| 40 | G.E. (2) | CD-1441 | 400/1500 |
| 40 | Cr.Wh. | CCM | 700 |
| 40 | Rel. | 461T | 400/1200 |
| 35 | West. | SK | 250/1000 |
| 35 | West. | SK-120 | 1150 |
| 35 | G.E. | RLC | 440/800 |
| 30 | West. | SK | 975 |
| 30 | Cont. | D-103 | 850 |
| 30 | G.E. | RC-33 | 775 |
| 30 | West. | SA | 500/1500 |
| 30 | West. (2) | SK-143 | 575 |
| 25 | G.E. | RC-15 | 1750 |
| 25 | West. | SK-88 | 1750 |
| 25 | G.E. | *CDM-77 | 1750 |
| 25 | E.D. | 10S | 1500 |
| 25 | Rel. | 92T | 1150 |
| 25 | West. | SA | 500/1500 |
| 25 | West. (2) | SK-130 | 600 |
| 25 | G.E. | RF-14 | 800/1200 |

### 115 V.D.C. MOTORS

| H.P. | Make | Type | Speed |
|---|---|---|---|
| 300 | West. | SK | 900 |
| 100 | Cr.Wh. | CMC | 900 |
| 50 | G.E. | CD | 1150 |
| 40 | G.E. | CD-113 | 850 |
| 30 | West. | S | 600 |
| 25 | G.E. (2) | CD | 1800 |
| 25 | West. | SK-103 | 1150 |
| 25 | Cr.Wh. | CCM | 750 |
| 25 | West. | SA | 600/1200 |
| 15 | E.D. | 7½S | 650/1230 |
| 15 | Cr.Wh. | CM | 650 |
| 10 | Al.Ch. | | 900 |
| 10 | E.D. | 7½S | 425/1700 |

### 550 V.D.C. MOTORS

| H.P. | Make | Type | Speed |
|---|---|---|---|
| 765 | G.E. (3) | MPC | 1045/1350 |

### AC GENERATORS

| KW | Make | Type | Speed |
|---|---|---|---|
| 180 | G.E. | ATB | 900 |
| 100 | G.E. | ATB | 360 |
| 50 | F-M | GG | 1200 |
| 15 | G.E. | ASI | 1200 |

### AC GENERATORS
**Driven by DC Motors**

| KVA | Make | D.C. Input | A.C. Output |
|---|---|---|---|
| 62½ | G.E. | 230 | 240 |
| 50 | Star | 115 | 120 |
| 35 | G.E. | 230 | 220 |
| 31 | Ideal | 115 | 440 |
| 31 | El. Machry. | 230 | 440 |
| 18 | G.E. (3) | 230 | 120/240 |
| 10 | Burke | 115 | 120 |
| 7½ | Hertner | 115 | 440 |
| 6¼ | G.E. | 230 | 240 |
| 5 | El. Spec. | 115 | 110 |
| 1¼ | Al. Ch. | 230 | 110 |

### 600 V.D.C. GENERATORS

| KW | Make | Speed |
|---|---|---|
| 400 | G.E. (4) | 1200 |
| 225 | G.E. | 1200 |
| 30 | Burke | 1750 |
| 20 | Reliance | 1150 |

### GENERATORS
**250 V.D.C. Motor Driven**

| KW | Make | Speed |
|---|---|---|
| 300 | Elliott | 1200 |
| 250 | G.E. | 1150 |
| 200 | G.E. | 1200 |
| 200 | West. Roto-trol | 1200 |
| 150 | West. | 900 |
| 100 | Delco | 1200 |
| 100 | G.E. | 700 |
| 75 | G.E. | 1200 |
| 40 | Rel. | 1750 |
| 42 | ABC (2) | 1200 |
| 30 | G.E. | 1200 |
| 25 | G.E. | 1200 |

### 125 V.D.C. Motor Driven

| KW | Make | Speed |
|---|---|---|
| 225 | G.E. (2) | 1200 |
| 150 | West. (2) | 1200 |
| 100 | West. (2) | 900 |
| 100 | G.E. | 1200 |
| 100 | El. Machry. | 1200 |
| 50 | West. (2) | 1150 |
| 30 | G.E. | 1150 |
| 30 | L.A. | 1450 |
| 25 | El. Machry. | 1150 |

### GENERATORS
**Low Voltage D.C.**

| Amp. | Make | Voltage |
|---|---|---|
| 125 | Hobart (8) | 7½ |
| 1500 | Century | 24 |
| 2000 | G.E. | 24V |
| 100 | G.E. | 30 |
| 1000 | G.E. | 33 |
| 150 | Watton | 40 |
| 1000 | Chandeysson | 40 |
| 200 | G.E. | 42 |
| 1500 | G.E. | 50 |
| 1500 | Century | 60 |
| 1500 | G.E. | 60 |
| 1000 | G.E. | 75 |

### FREQUENCY CHANGERS AND GENERATORS

| Size | Make | Output Frequency |
|---|---|---|
| 150 KW | G.E. | 180 cy. |
| 154 KVA | G.E. | 180 cy. |
| 15 KW | G.E. | 408 cy. |
| 10 KW | G.E. | 200/700 cy. |
| 7½ KW | G.E. | 408 cy. |
| 3 KW | G.E. | 408 cy. |

### ELECTRIC HOISTS

1000# Y & T—D.C.
1000# Thor—Air.
1000# Y & T—A.C. (2)
1000# Shepard—A.C.
2000# R & M—D.C. (3)
2000# C & M—D.C.
4000# Thor—Air
6000# R & M—A.C.

### STARTERS—D.C.

1—600 H.P. 230V. West. magnetic.
150—New 230V. D.C. magnetic starters, from 5 H.P. to 75 H.P. C-H, G.E., etc.
40—New 7½ H.P. 230V. magnetic reversing.
1—300 H.P. West. 115V. magnetic.

### TRAVELING CRANES

2 Ton Harnischfeger, 26' 8¼" Span

**GUARANTEE**
**YOUR INVESTMENTS!**

- LAND gives 1 year guarantee.
- All equipment listed in stock.
- You can see your machines run and tested under power before shipment.
- Complete shop facilities with thoroughly trained & experienced mechanics (many have been with us over 25 years).
- Responsible Organization — 41 years' experience.

**Partial List ONLY**

EST. 1910 — **L. J. LAND INC.** — 41st YEAR

156 GRAND STREET — Phone CAnal 6-0178 — NEW YORK 13, N. Y.

# ELECTRICAL EQUIPMENT — REBUILT and GUARANTEED

MOTORS—GENERATORS—MG SETS—TRANSFORMERS—CONTROLS

## PROMPT SHIPMENT — PARTIAL LISTING

### 800/1600 AMPERE ARC WELDING MOTOR GENERATOR SETS

Each set consists of two generators and one motor, mounted on base. Each Generator: Northwestern Type K20DR, 800 amperes, 50 volts, 1750 RPM. Motor: 125 HP, Allis Chalmers, Type AR, 2200 volts, 3 phase, 60 cycle, 1750 RPM.

### SLIP RING MOTORS—3 Ph., 60 Cy.

| Qn. | HP | Speed | Volts | Make | Type |
|---|---|---|---|---|---|
| 6 | 7½ | 910 | 550 | G.E. | MTC-5301 |
| 2 | 10 | 1140 | 410 | West. | HF-7A |
| 2 | 10 | 570 | 220 | G.E. | HI-11 |
| 2 | 111 | 820 | 550 | G.E. | ITC-5008 |
| 2 | 15 | 1160 | 440 | West. | CW-464C |
| 2 | 15 | 570 | 220 | West. | CW-646 |
| 1 | 15 | 680 | 440 | West. | MW-316 |
| 1 | 20 | 860 | 440 | West. | CW-638 |
| 1 | 25 | 1130 | 550 | G.E. | MT-323 |
| 2 | 25 | 350 | 220 | Wagner | BR |
| 2 | 25 | 720 | 440 | Wagner | 22VBR |
| 1 | 30 | 865 | 440 | West. | CW-646 |
| 1 | 30 | 350 | 440 | G.E. | MT-332 |
| 1 | 30 | 675 | 440 | G.E. | MT-336 |
| 2 | 35 | 600 | 400 | F-M | HV-H16A |
| 2 | 40 | 885 | 2200 | Al.Ch. | ARV-223C |
| 1 | 40 | 860 | 440 | G.E. | MT-346 |
| 2 | 50 | 1150 | 440 | G.E. | M-536 |
| 1 | 50 | 860 | 440 | West. | HF-12A |
| 1 | 50 | 570 | 440 | G.E. | MT-853 |
| 1 | 50‡ | 550 | 220 | G.E. | IQC-5013*** |
| 1 | 60 | 865 | 440 | West. | CW-758 |
| 1 | 60 | 570 | 550 | G.E. | MTC-5546 |
| 1 | 60 | 945 | 550 | West. | CW-938 |
| 1 | 80‡ | 575 | 440 | G.E. | MTC-5352 |
| 3 | 125 | 430 | 440 | G.E. | II-16 |
| 2 | 150 | 1750 | 440 | G.E. | MTW-549 |
| 1 | 175 | 865 | 550 | West. | CW-1002 |
| 1 | 200 | 495 | 2300 | G.E. | IM-17A |
| 1 | 250 | 600 | 2300† | G.E. | IM-17 |
| 1 | 300 | 900 | 2300 | G.E. | IM-17 |
| 2 | 300 | 880 | 2200 | G.E. | IM-17A |
| 4 | 350 | 1775 | 2300 | G.E. | IM-E15A |
| 2 | 350 | 885 | 2200 | G.E. | IM-17A |
| 1 | 400 | 508 | 550 | West. | CW |
| 1 | 600 | 1770 | 440 | G.E. | IM-E15C |
| 1 | 600 | 880 | 440 | G.E. | MT-442Y |
| 1 | 700 | 735 | 4000‡‡ | West. | CW |

220 volt motors can be reconnected for 440 volts.
‡Intermittent rating. ***2 phase.
**New. ‡‡25 cycle.
†Also 440 or 550 volts. *Also 440 or 2300 volts.

### A.C. GENERATORS — NEW

3 Phase, 60 Cycle, 0.8 P.F., Two Bearing, with Damper Winding & Direct Connected Exciter.

| Qn. | KVA | Make | Volts |
|---|---|---|---|
| 4 | 18.7 | 1800 | Columbia 240/120 |
| 4 | 18.7 | 1800 | Columbia 208/120 |

### 230 VOLT CONST. SPEED D.C. MOTORS

| Qn. | HP | Speed | Make | Type |
|---|---|---|---|---|
| 10 | 2 | 850 | Reliance | Y-23T |
| 25 | 3½ | 850 | West. | SK-30 |
| 1 | 7½ | 1150 | G.E. | CDM-66 |
| 3 | 7½ | 850 | G.E. | CD-75 |
| 10 | 10** | 1750 | Kimble | BA-324 |
| 15 | 10** | 1150 | Al.Ch. | EB-80 |
| 2 | 10 | 850 | West. | SK-83 |
| 10 | 13½** | 600 | West. | SK-93 |
| 3 | 15 | 1750 | G.E. | CD-75 |
| 5 | 15 | 825 | West. | SK-96 |
| 1 | 20 | 1750 | L.A. | ONA-L851 |
| 1 | 20** | 1160 | G.E. | CDM-83 |
| 1 | 20 | 1750/1310 | West. | SK-83 |
| 2 | 20 | 1160 | G.E. | RC-30 |
| 1 | 20** | 1450 | G.E. | CDM-38 |
| 11 | 20 | 750 | West. | SK-110L |
| 17 | 25 | 825 | West. | SK-120 |
| 1 | 30 | 1160 | G.E. | RC-12 |
| 1 | 40 | 1700 | West. | SK-103 |
| 1 | 40 | 750 | G.E. | RC-34 |
| 1 | 50 | 750 | West. | SK-150 |
| 1 | 50 | 650 | G.E. | RC-16 |
| 1 | 150 | 700 | Al.Ch. | |
| 2 | 200 | 1150 | G.E. | RC-38 |
| 1 | 250 | 1150 | C.W. | CMC-101A |

### 230 VOLT ADJ. SPEED D. C. MOTORS

| Qn. | HP | Speed | Make | Type |
|---|---|---|---|---|
| 8 | 0/7½ | 600/1800 | G.E. | EA-90 |
| 1 | 10 | 400/1600 | Reliance | T-92T |
| 1 | 12½ | 230/340 | West. | SK-130 |
| 10 | 12½** | 500 | West. | SK-93 |
| 1 | 15 | 600/1200 | West. | SK-100L |
| 1 | 20 | 500/1500 | G.E. | RF-11 |
| 1 | 20/25 | 100/1200 | West. | SK-153 |
| 1 | 25 | 400/1600 | G.E. | RF-13 |
| 1 | 25 | 500/1500 | G.E. | RF-12 |
| 1 | 33/39 | 300/1200 | G.E. | RF-13 |
| 1 | 30 | 300/1200 | West. | SK-163 |
| 1 | 30/40** | 400/1600 | G.E. | CD-1236 |
| 1 | 35 | 500/1500 | West. | SK-143 |
| 1 | 40/50 | 400/1200 | Reliance | T-4611 |
| 1 | 75 | 500/1500 | Cr.Wh. | CCM |
| 1 | 75 | 375/750 | Cr.Wh. | |
| 3 | 100 | 225/900 | G.E. | MPC-125M |
| 5 | 100 | 600/1200 | Al.Ch. | |
| 1 | 100 | 320/960 | West. | S C-200 |
| 1 | 125 | 450/1000 | West. | S C-190 |
| 1 | 175 | 230/500 | West. | SK-220 |
| 2 | 375 | 350/500 | G.E. | MPC |

### SQUIRREL CAGE MOTORS—3 Ph., 60 Cy.
Totally Enclosed Fan Cooled, Ball Bearing

| Qn. | HP | RPM | Volts | Make | Type |
|---|---|---|---|---|---|
| 2 | 3 | 1160 | 440 | L.A. | JS-254 |
| 8 | 5 | 1730 | 440 | G.E. | K-254 |
| 4 | 7.5 | 1740 | 440 | G.E. | K-284 |
| 1 | 10 | 1735 | 440 | West. | CS-321 |
| 2 | 10 | 1165 | 440 | West. | CS-326-EXP |
| 1 | 10 | 1140 | 440 | Wagner | CP2-326 |
| 1 | 15 | 1745 | 440 | West. | CS-326 |
| 1 | 15 | 1175 | 440 | L.A. | JA-365 |
| 1 | 20 | 1760 | 220 | G.E. | K-364 |
| 1 | 25 | 1200 | 550 | G.E. | K-405 |
| 1 | 25 | 1170 | 220 | L.A. | JX-405 |
| 1 | 25 | 705 | 440 | West. | CS-W504 |
| 1 | 40 | 3565 | 440 | G.E. | KF-4058 |

### SPLASHPROOF, BALL BEARING

| Qn. | HP | RPM | Volts | Make | Type |
|---|---|---|---|---|---|
| 1 | 3 | 1160 | 440 | L.A. | FS-254 |
| 23 | 5 | 1750 | 440 | L.A. | FS-254 |
| 1 | 5 | 1735 | 220 | G.E. | K-254 |
| 1 | 5 | 1160 | 440 | L.A. | FX-284 |
| 4 | 15 | 1150 | 440 | L.A. | FX-365 |
| 1 | 50 | 1760 | 440 | L.A. | FX-445A |
| 5 | 50 | 1160 | 220 | G.E. | K-504 |
| 1 | 150 | 1775 | 440 | L.A. | FX-1168 |
| 3 | 150 | 880 | 440 | L.A. | FX-1368 |
| 1 | 150 | 700 | 440 | G.E. | KF-6335 |

### OPEN TYPE MOTORS

| Qn. | HP | Speed | Volts | Make | Type |
|---|---|---|---|---|---|
| 1 | 15 | 3485 | 220 | Reliance | AA-B3247 |
| 5 | 15** | 1735 | 440 | Century | SC326 |
| 1 | 15 | 1200 | 220 | G.E. | KT-502 |
| 1 | 15 | 900 | 220 | G.E. | FTR-512 |
| 1 | 20** | 3475 | 220 | West. | CS-326 |
| 5 | 20** | 1750 | 440 | Wagner | RPI-364 |
| 1 | 20 | 1750 | 220 | West. | CS-W364 |
| 1 | 20 | 1200 | 220 | G.E. | KF-512 |
| 2 | 20 | 1160 | 440 | West. | CS-464C |
| 2 | 20 | 900 | 220 | G.E. | FTR-522 |
| 1 | 25 | 1800 | 220 | G.E. | KT-312 |
| 5 | 25** | 1740 | 440 | Century | SC-364 |
| 1 | 25 | 1160 | 440 | West. | CS-667C |
| 1 | 25 | 900 | 220 | Howell | SCRB-356*** |
| 2 | 25** | 875 | 440 | Master | PB-405 |
| 2 | 25 | 575 | 440 | G.E. | KT-542 |
| 3 | 30 | 3550 | 550 | G.E. | K-3648 |
| 1 | 30 | 1735 | 220 | G.E. | FT-513 |
| 1 | 30 | 1160 | 440 | West. | CS-644 |
| 1 | 30 | 870 | 220 | West. | CS-646 |
| 1 | 40** | 3548 | 220 | G.E. | KF-4048 |
| 2 | 40 | 1750 | 440 | West. | CS-883C |
| 2 | 40 | 900 | 2300 | G.E. | FTR-536 |
| 4 | 50** | 1750 | 440 | Wagner | RP5-405 |
| 1 | 50 | 850 | 220 | West. | CCL |
| 2 | 60* | 1750 | 440 | Ideal | AH-444 |
| 2 | 60 | 900 | 440 | G.E. | KT-346 |
| 1 | 75 | 1160 | 440 | West. | CS-662C |
| 4 | 75 | 870 | 220 | West. | CS-766A |
| 2 | 75 | 865 | 2300 | G.E. | KT-352 |
| 1 | 100 | 690 | 220 | West. | C |
| 1 | 100 | 580 | 2200 | G.E. | IR-15A |
| 2 | 100 | 500 | 2200 | West. | CS-930 |
| 1 | 100 | 495 | 2200 | Al.Ch. | AN |
| 1 | 125 | 435 | 440 | Al.Ch. | AR |
| 2 | 125 | 400 | 2300 | G.E. | I-17-FR |
| 1 | 200 | 580 | 550‡‡ | G.E. | KT-5608 |
| 2 | 300 | 587 | 2200 | West. | CS-39A |
| 1 | 500 | 1200 | 140 | G.E. | KTP-567 |
| 1 | 700 | 1800 | 2300/ 4000 | West. | CS-4-39D-12 |

220 volt motors can be reconnected for 440 volts.
**New. ***2 Phase. ‡‡Reconnectable for 440 volts

### G. E. DYNAMOMETER

Cradle Type, with control and Dial Scale. (Write for Complete Specifications.)

| Qn. | HP | DC Volts | RPM | Type |
|---|---|---|---|---|
| 1 | 200 | 250 | 1200 | C |

### MOTOR GENERATOR SETS

125 and 250 Volts D. C.

(Write for complete Specifications)

| KW | Make | RPM | DC Volts | AC Volts |
|---|---|---|---|---|
| 2 | Cont. | 1750 | 125 | 220/440 |
| 7.5 | West. | 1455 | 125 | 380/220§ |
| 10 | West. | 1750 | 125 | 220/440 |
| 10 | West. | 1450 | 125 | 220/440† |
| 10 | West. | 1150 | 250 | 220/440 |
| 15** | G.E. | 1800 | 125 | 220/440 |
| 15 | G.E. | 1755 | 250 | 220/440 |
| 15 | West. | 1450 | 125 | 220/440§ |
| 16 | West. | 1750 | 125 | 2200/440 |
| 25 | G.E. | 1200 | 125 | 220/440 |
| 30 | Al.Ch. | 1750 | 125 | 220/440 |
| 50 | G.E. | 1720 | 125 | 220/240† |
| 75 | G.E.* | 1200 | 125 | 220/240 |

Note: 3KW, 5KW & 7.5KW, 250V Sets Available
**New. *Synch. Motor Driven. §50 Cy. †25 Cy.

Above Items Represent a Partial Listing Only. Your Inquiries Will Receive Our Prompt Attention. All Equipment is Located in Our Cleveland Warehouse. We have Controls for Most Items Listed.

## ELECTRIC GENERATOR & MOTOR CO.

4521 HAMILTON AVE. CLEVELAND 14, OHIO

# BOILERS

1—1300 H.P. Walsh-Widener, sectional header, cross drum, 225# W.P. Suspension steel, all trim, new circulators.

1—640 H.P. Walsh-Widener, sectional header, cross drum, 200# pressure Superheater, all trim, Detrick air cooled walls.

1—484 H.P. Springfield Sectional header, water tube. 336 tubes, 3"x18', 11 gauge seamless steel, 250# W.P. Superheater, soot blowers, draft gage, flow meters, Copes feedwater regulator, damper regulator, all trim.

2—408 H.P. Erie City Box Header type Cross Drum, 240# pressure, all usual boiler trim, soot blowers.

2—400 H.P. Casey-Hedges, sectional header, cross drum, 200# pressure, Complete with structural steel, Soot blowers.

1—390 H.P. Springfield, sectional header, 300# design pressure, 125°F superheat. Water walls, all trim, soot blowers.

2—363 H.P. Springfield, sectional headers, 250# W.P. Superheater, all trim.

1—286 H.P. 150# W.P. 1942 HRT. Peabody oil burners and dual pump sets also sawdust burning eqpt. Stack, all trim.

1—250 H.P. Titusville, 150# double corrugated furnace, Scotch Marine, York Rotary oil burner. Preheaters, Panel Board. All usual boiler trim.

1—250 H.P. B&W, 160# W.P. cross drum, sectional header Detroit stoker.

2—250 H.P. Erie City, 200# W.P. Oil burners and pump sets, Headers, complete with Feedwater regulating system and misc. equipment.

1—210 H.P. BROS self contained Water Tube, steel encased. Output 11,000# steam continuous. 150# W.P.

1—150 H.P. Scotch Marine, 15# W.P., Ray Rotary Oil Burner, pumps and receivers.

1—150 H.P. Farrar & Threft's Fire Box Type, 150# W.P. ASME and Nat'l Board. Hand fired grates. Usual Boiler trim.

1—150 H.P. Bigelow Scotch Marine, 150# W.P. Peabody burner.

1—150 H.P. Erie City Economic 150# W.P. ASME and N.J. Std.

2—109 H.P. Brownell RD 125, oil fired, Ray Rotary Burners.

1—104 H.P. Kewanee, 250# W.P. complete with grates, fire doors, ash pit doors, injector, feedwater heater, Boiler feed pump & piping.

1—100 H.P. Titusville, 150# W.P. with Todd Rotary Burner.

1—50 H.P. Cyclotherm, 125# W.P., fully automatic for No. 5 oil.

1—40 H.P. Erie City, 150# W.P., Ray oil burner, pump, regulator.

2—20 H.P. Cleaver-Brooks, with pump.

1—15 H.P. Cleaver-Brooks, 125# W.P. with pump & receiver.

1—15 H.P. York, with pump and receiver.

1—10 H.P. Orr & Sembower with pump & receiver.

1—9.7 H.P. Steamaster, 125#, oil fired.

1—B&W Stirling V2-28-470. 3¼" tubes, capacity 39,500# per hr. 200# W.P. no superheat.

1—B&W FF-16, 425# W.P. capacity 30,000# steam per hr, 700°F steam temperature, 3265 sq. ft. heating surface boiler, 776 sq. ft. in water walls. B&W pulverizers, pumps, all controls and trim.

1—1948 Skelly stoker, complete.

1—1947 Combustion Engineering Spreader with Hogen controls. Cinder recovery system. For 600 H.P. Boiler.

1—4'x6' ASME Receiver or air Tank. 230# W.P.

1—Western Precipitator

1—Reeves Drive for stoker.

1—Superheater, 40,000# to 45,000#, 100°F.

We also carry a substantial inventory of Boilers and Firing Equipment of practically every description. Send us your list of requirements.

Telephone MUrray Hill 2-9098

## WARNER J. SHERB, INC.

342 Madison Avenue, New York, N. Y.

# WORLD'S LARGEST INVENTORY

Established 1934

D & B Rated

ELECTRIC EQUIPMENT CO., ROCHESTER, N.Y.—JULY LIST

## ELECTRIC EQUIPMENT CO., ROCHESTER, N. Y.—A JULY LIST

*WRITE FOR NEW 1951 CATALOG AND SPECIAL APPOINTMENT CALENDAR.*

### TRANSFORMERS

| Quan. | KVA | Primary Volts | Secondary Volts | Phase |
|---|---|---|---|---|
| 2 | 3000 | 23,000 | 2300 | 3 |
| 1 | 1500 | 2,300 | 600 | 3 |
| 1 | 1000 | 2,300 | 220 | 3 |
| 6 | 1000 | 66,000 | 7200 | 1 |
| 3 | 750 | 2,400 | 480 | 1 |
| 6 | 500 | 2,400 | 480 | 1 |
| 3 | 500 | 12,000 | 2300 | 1 |
| 3 | 450 | 23,000 | 440 | 1 |
| 3 | 333 | 2,400 | 600 | 1 |
| 3 | 333 | 2,400 | 240/480 | 1 |
| 3 | 333 | 13,200 | 240/480 | 1 |
| 3 | 333 | 11,500 | 240/480 | 1 |
| 3 | 300 | 2,400 | 120/240 | 1 |
| 6 | 250 | 2,400 | 240/480 | 1 |

Plus 734 smaller units 1 KVA to 100 KVA

### MOTOR GENERATOR SETS AC — DC

| Quan. | KW | Make | Volts |
|---|---|---|---|
| 1 | 1000 | General Electric | 250 |
| 6 | 1000 | General Electric | 600 |
| 1 | 750 | Allis-Chalmers | 250 |
| 2 | 500 | Westinghouse | 250 |
| 2 | 500 | Westinghouse | 1500 |
| 1 | 500 | Westinghouse | 125 |
| 1 | 400 | Westinghouse | 125/250 |
| 2 | 300 | General Electric | 125/250 |
| 1 | 300 | General Electric | 500 |
| 1 | 250 | General Electric | 250 |
| 1 | 200 | Westinghouse | 250 |
| 1 | 200 | General Electric | 250 |
| 2 | 200 | General Electric | 125 |
| 1 | 150 | General Electric | 250 |
| 1 | 150 | General Electric | 125 |
| 3 | 100 | General Electric | 125 |
| 4 | 100 | General Electric | 250 |
| 1 | 100 | Allis-Chalmers | 125/250 |

Plus 238 sets from 1 KW to 75 KW in stock.

### DC TO AC

| Input | | Output |
|---|---|---|
| 1 | 800 HP—230 V. | 200 KW, 440/60/3 |
| 1 | 125 HP—230 V | 75 KW, 125 V, DC |
| 1 | 25 HP—230 V | 15 KW, 230/60/3 |
| 1 | 25 HP—230 V | 15 KVA, 230/60/1 |
| 35 | 20 HP—230 V | 12½ KVA, 440 V, 3 ph. .5 P. F. |
| 40 | 7½ HP—230 V | 7½ KVA, 120/60/1 |
| 20 | 6 HP—115 V | 5 KW, 120/60/1 |
| 5 | 3 HP—115 V | 2 KVA, 110/25/1 |
| 10 | 1½ HP—115 V | 1 KVA, 110/60/1 |
| 10 | 1 HP—115 V | ½ KVA, 110/60/1 |

### ROTARY CONVERTORS

| Quan. | KW | Make | Speed | Volts |
|---|---|---|---|---|
| 5 | 500 | General Electric | 1200 | 250 |
| 7 | 400 | Westinghouse | 1200 | 250 |
| 1 | 100 | General Electric | 1200 | 250 |

P.S.—We Stock Explosion-Proof Motors—Class 1-D & 2-G

### WANTED

3—200 KVA Transformers, 2400/240/480.
3—500 KVA Tranformers 13800, 230/460
1—400 HP, 2300/60/300 rpm slip-ring motor.
3—500 KVA Transformers 12000, 230/460

### AC GENERATORS

ALTERNATORS—CONDENSERS

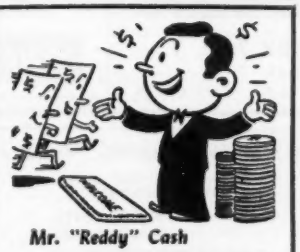
| Quan. | KVA-HP | RPM | CYCLE |
|---|---|---|---|
| 1 | 2500 | 720 | 60 |
| 1 | 2500 | 900 | 60 |
| 1 | 1675 | 600 | 40 |
| 2 | 1500 | 900 | 60 |
| 1 | 1430 | 514 | 60 |
| 1 | 1250 | 1200 | 60 |
| 1 | 1000 | 750 | 25 |
| 1 | 800 | 900 | 60 |
| 3 | 750 | 900 | 60 |
| 2 | 650 | 139 | 60 |
| 1 | 500 | 720 | 60 |
| 1 | 500 | 750 | 25 |
| 1 | 400 | 450 | 60 |
| 3 | 400 | 1800 | 60 |
| 1 | 350 | 750 | 25 |
| 1 | 350 | 720 | 60 |
| 1 | 350 | 225 | 60 |
| 1 | 333 | 1800 | 960 |
| 1 | 320 | 1200 | 120 |
| 1 | 300 | 750 | 25 |
| 1 | 300 | 180 | 60 |
| 1 | 250 | 720 | 60 |

Plus 75 smaller units from 3 KVA to 200 KVA

### SLIP RING MOTORS

| Quan. | HP | Speed | Make |
|---|---|---|---|
| 1 | 600 | 1800 | G. E. |
| 1 | 500 | 1800 | G. E. |
| 1 | 500 | 514 | Al. Ch. |
| 4 | 500 | 900 | G. E. |
| 1 | 350 | 720 | G. E. |
| 1 | 300 | 450 | G. E. |
| 1 | 300 | 514 | G. E. |
| 1 | 300 | 900 | G. E. |
| 1 | 300 | 720 | G. E. |
| 1 | 200 | 600 | G. E. |
| 1 | 200 | 1200 | G. E. |
| 2 | 150 | 720 | G. E. |
| 1 | 125 | 1200 | Al. Ch. |
| 1 | 100 | 900 | Wagner |
| 4 | 100 | 450 | G. E. |
| 8 | 75 | 720 | West. |

Plus 937 smaller units 1 HP to 40 HP



*Mr. "Reddy" Cash*

*Wants Your Surplus List!*

Note: We Stock 6000 New Motors, Controls, Frequency Changers

SEND US YOUR INQUIRIES!

### DC MOTORS

ADJUSTABLE SPEED—230 VOLT

| Quan. | HP | Make | Volts |
|---|---|---|---|
| 1 | 300 | General Electric | 400/800 |
| 1 | 250 | West. | 250/675 |
| 4 | 40/250 | West. | 540/3000 |
| 1 | 150 | West. | 300/900 |
| 1 | 100 | Reliance | 500/1500 |
| 1 | 100 | G. E. | 400/1000 |
| 1 | 100 | West. | 450/1350 |
| 1 | 100 | G. E. | 1050/4000 |
| 1 | 90 | F. M. | 500/1500 |
| 1 | 75 | G. E. | 400/1200 |
| 1 | 60 | G. E. | 220/1000 |
| 1 | 60 | G. E. | 300/1200 |
| 1 | 60 | G. E. | 250/1000 |
| 1 | 50 | G. E. | 400/1200 |
| 1 | 40 | G. E. | 250/1000 |
| 1 | 40 | Cr. Wh. | 400/1600 |
| 1 | 35 | West. | 250/1000 |
| 1 | 35 | G. E. | 500/1000 |
| 1 | 30 | Reliance | 400/1200 |
| 1 | 30 | Cr. Wh. | 500/1500 |
| 1 | 25 | Reliance | 400/1600 |

Plus 327 smaller units 1 HP to 20 HP

### 60 CYCLE MOTORS

SQUIRREL CAGE MOTORS

| HP | SPEED | MAKE |
|---|---|---|
| 500 | 720 | G. E. |
| 400 | 1200 | West. |
| 400 | 514 | West. |
| 300 | 600 | West. |
| 250 | 3600 | G. E. |
| 250 | 1200 | G. E. |
| 200 | 600 | Al. Ch. |
| 200 | 1800 | Wagner |
| 150 | 720 | G. E. |
| 150 | 600 | G. E. |
| 150 | 1200 | Al. Ch. |
| 150 | 1800 | Al. Ch. |

P.S. We stock 3500 new and rebuilt 1 HP to 100 HP

### CONSTANT SPEED 230 VOLT

| HP OR KW | MAKE | Speed |
|---|---|---|
| 400 HP | Elec. Dyn. | 1500 |
| 300 KW | G. E. (170 V) | 1200 |
| 300 HP | Cr. Wh. | 1200 |
| 250 KW | Al. Ch. | 720 |
| 150 KW | West. | 720 |
| 125 HP | Star | 1200 |
| 100 HP | G. E. | 900 |
| 75 HP | G. E. | 1200 |
| 75 KW | G. E. 325 V | 1200 |
| 50 HP | West. | 1200 |
| 50 HP | Burke | 1800 |

Plus 675 smaller units 1 HP to 40 HP also 115 V & 550 V, DC.

### SQUIRREL CAGE AND SLIP RING—25 CYCLE

| Quan. | HP | Speed | Make |
|---|---|---|---|
| 1 | 650 | 865 rpm | S.R. |
| 1 | 350 | 750 | S.C. |
| 1 | 300 | 750 | S.C. |
| 1 | 300 | 375 | S.R. |
| 4 | 200 | 500 | S.R. |
| 1 | 200 | 750 | S.C. |
| 1 | 200 | 750 | S.R. |
| 1 | 200 | 500 | S.C. |
| 1 | 200 | 1500 | S.C. |

Plus 872 smaller units 1 HP to 150 HP

# ELECTRIC EQUIPMENT COMPANY

PHONE LD 65

New and Rebuilt ROCHESTER, N. Y. 1 H. P. to 2500 H. P.

MOTORS · MG SETS · TRANSFORMERS · CONTROLS · COMPRESSORS

# There's more than 40% to 60% SAVINGS on

## SCHOONMAKER DEPENDABLE DIESEL POWER

## because:

Each Schoonmaker-sold Diesel Engine Unit is fully REMANUFACTURED in our plants by highly skilled, factory-trained Diesel engineers. Only genuine factory-made and approved parts are used and all REMANUFACTURING is in strict accordance with manufacturer's recommended procedures. Prior to shipment every engine is subjected to a FULL LOAD operating test in accordance with DEMA standards.

The Schoonmaker Plants and Warehouses located in Jersey City, N. J. and Sausalito (San Francisco), California give NATIONWIDE SERVICE from Coast to Coast with modern, efficient and reliable facilities.

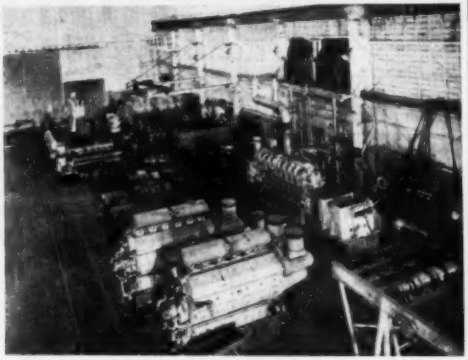
Our reputation and many years of experience and SPECIALIZATION in Diesel power equipment gives you value that money cannot buy elsewhere.

So—Buy SCHOONMAKER because you buy the FINEST in DEPENDABLE DIESEL POWER.

A.G. SCHOONMAKER CO., INC.

**52 CHURCH ST., NEW YORK 7, N. Y.**

PLANTS AND WAREHOUSES:
JERSEY CITY, N. J. AND SAUSALITO (S.F.), CALIFORNIA



PORTION OF ENGINE REMANUFACTURING FLOOR AND ONE OF THE ENGINE TEST STANDS AT OUR SAUSALITO, CALIF. PLANT.

**A PARTIAL LIST OF OUR INVENTORY**

| KW | MAKE | MODEL | HP | RPM |
|---|---|---|---|---|
| 1500 | Fairbanks Morse | 33E16 | 2000 | 300 |
| 1230 | Nordberg | F6G168SC | 1750 | 327 |
| 1136 | Fairbanks Morse | 38D | 1600 | 720 |
| 1000 | General Motors | 16-278A | 1600 | 720 |
| 750 | General Motors | 12-567 | 1080 | 720 |
| 500 | Alco | 6-12-1/2x13T | 750 | 600 |
| 500 | Worthington | EE | 750 | 327 |
| 500 | General Motors | 8-567 | 720 | 720 |
| 340 | Baldwin | VO-6 | 510 | 450 |
| 320 | Buckeye | 80 | 480 | 600 |
| 300 | Enterprise | DSG-6 | 450 | 450 |
| 300 | General Motors | 8-268A | 450 | 1200 |
| 264 | Superior | KNA | 396 | 514 |
| 167 | Ingersoll-Rand | S | 255 | 600 |
| 160 | Buckeye | 80 | 240 | 600 |
| 100 | General Motors | 3-268A | 150 | 1200 |
| 100 | Worthington | BB-5 | 150 | 600 |
| 60 | General Motors | 6-71 | 90 | 1200 |
| 50 | Caterpillar | D-8800 | 76 | 1200 |

ALTERNATING AND DIRECT CURRENT UNITS
STANDARD AND SPECIAL VOLTAGES AS REQUIRED

**ONE YEAR GUARANTEE!**

***Most all units still on foundation. Many may be seen operating***

**TURBO GENERATOR UNITS**
**Condensing-Bleeders**

3750 KVA Wghse. 3/60/600-480 V (Bleeder)
1625 KVA Wghse 3/60/2300 V (Bleeder)
1250 KVA Wghse 3/60/2300/4150 V (450#)
1250 KVA GE 3/60/480-240-600 V (Bleeder)
1250 KVA Al. Chal. 2300/600 V
937 KVA GE 3/60/600 V Cond.
937 KVA Wghse-Moore 480 V (Bleeder)
750 KVA Al. Chal. 3/60/480-240 V
750 KVA Wghse 2300 V (250#)
625 KVA Wghse 2300/600 V
375 KVA Wghse 3/60/240/480 V

**TURBO GENERATOR UNITS**
**Non-Condensing**

625 KVA Al. Chal. 480/240 V
375 KVA (2) Al. Chal. 240/480V
250 KVA GE 2 stage 2300/600
187 KVA GE 480 V 370# (65-165# b.p.)
62 KVA GE-DeLaval 240/480 V

**DIESEL UNITS**
**240/440/2300 Volts**

1000 KVA Elliott-DeLaVergne
375 KVA Fairbanks Morse 32 E 14
375 KVA Wghse.-Chicago Pneumatic
250 KVA GE-Buckeye
250 KVA Fairbanks Morse 32E14
219 KVA Wghse-Buckeye
200 KVA Fairbanks Morse
187 KVA GE-Buckeye
175 KVA Fairbanks Mo se 32-E-14
168 KVA Wghse.-Buda. Passage type
90 KVA (2) Fairbanks Morse 32-E-14
75 KVA (2) General Motors
50 KVA (2) Fairbanks Morse
225 HP Buckeye (Belted)

**BOILERS**

540 HP. Keeler 250#
480 HP. B&W 250#
427 HP. Bigelow 3 drum. 200#
400 HP. (2) Wicks 3 drum 160#
370 HP. (2) Wicks Cr. drm. 300#
352 HP. Keeler cr. drm. 250#
333 HP. Bigelow 3 drm. 250#
300 HP. Union 160#
250 HP. (84x20) HRT 150#
220 HP. (2) Vogt 3 drm 160#
214 HP. Kewanee; loco. 125#
175 HP. Keeler; firebox 125#
151 HP. (3) Murray 250#
150 HP. Farrar; firebox 150#

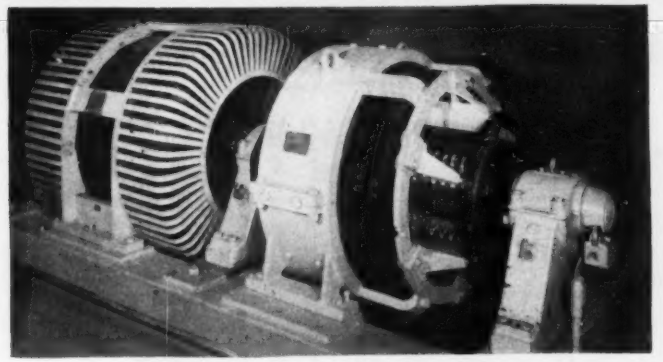
**CONDENSER**

4000 Sq. Ft. Wghse; & Air & Condens. Pump

***Above listed units are only a few of our "SPECIALS." Advise your plant requirements.***

# POWER PLANT EQUIPMENT CO., INC.

39 Cortlandt St.
New York, N. Y.



500 K.W. Westinghouse Motor Generator Set

## MOTOR GENERATOR SETS
### Philadelphia Stock

1—1000 K.W. Westinghouse 250 volt Flat Compound 500 RPM 1440 H.P. West. Syn. Motor .8 P.F. 3/25 cycle 2300 V. A.C. & D.C. Panels Modern Unit—Can furnish 60 cycle 2300 or 13200 volt.

1—600 KW G.E. MPC—2400 amp. 230 volt 514 RPM with 1050 H.P. G.E.—ATI Syn. Motor .8 P.F. 2 phase, 60 cycle, 2300 volt A.C. & D.C. Panels—Can furnish 3 ph. 550 V. or 2300 V.

2—500 KW Westinghouse 250 Volt 900 RPM with 720 H.P. West. Syn. Motors 3/60/2300/13200 volt, Serial #8130447-48 (year 1935) See actual photo above.

1—500 K.W. Crocker Wheeler CCD, 250 volt 720 RPM with 750 KVA Cr. Wh. Syn. Motor 3/60/2300 V. A.C. & D.C. Panels—Like New.

1—450 K.W. G.E. Type CY-225 (1941 year) 250 volt 1200 RPM direct connected 650 HP GE-ATI-Syn. Motor 3/60/480 volt. Magnetic Red. Voltage Starter.

3—300 K.W. West. 3 wire 125/250 Volt 1200 RPM Generators (1938 year). Can furnish with suitable motor as single unit or as 600 K.W. 3 Unit Set. Advise Requirement.

1—300 K.W. Elliott 250 Volt 1200 RPM with 500 H.P. Syn. Motor 3/60/2300/1200 RPM—Automatic Controller & D.C. Panel.

2—150 K.W. G.E. Type MPC—250 Volt 1200 RPM 3/60/2300/200 H.P. Syn. Motor Drive A.C. & D.C. Panels.

1—150 K.W. West. SK 184, 3 wire 125/250 Volt 1200 RPM (1938 yr.) 250 H.P. West. Syn. .8 P.F. 2/60/220 or 3/60/220/440/550/2300 V.

1—100 K.W. Al. Chalmers 250 Volt 1200 RPM 150 H.P. Syn. Motor 2/60 or 3/60 any voltage.

1—100 K.W. G.E.—C.D.—125 Volt D.C. 150 H.P. GE Syn. Motor, 3/60/220/440/1200 RPM.

1—75 K.W. BURKE 250 Volt 900 RPM 113 H.P. Burke—Syn. M.D. 2 phase any voltage.

1—50 K.W. West. SK—240 Volt with West. Syn. M.D. 3/60/220/440/1200 RPM.

Smaller Sizes and Types—Advise Requirements.

## ELECTRIC MOTORS

| Q. | H.P. | Make | Type | Volts | Speed |
|---|---|---|---|---|---|
| 1 | 1200 | Cr. Wh. | Sl. Rg. | 2300 | 257 |
| 1 | 700 | G.E. | ATI (syn) | 480 | 1200 |
| 2 | 600 | West. | Syn. | 440 | 257 |
| 3 | 500 | West. | CS | 2300/6600 | 514 |
| 3 | 500 | E.M. | Syn. | 2300 | 1200 |
| 1 | 400 | G.E. | Syn. | 2300 | 450 |
| 1 | 400 | West. | CW | 440 | 514 |
| 1 | 350 | G.E. | MT18 | 2300 | 400 |
| 1 | 315 | G.E. | Syn. | 2200 | 720 |
| 1 | 250 | West. | CS | 2300 | 1200 |
| 1 | 250 | West. | CS | 440 | 450 |
| 1 | 200 | West. | Syn. | 2300 | 1200 |
| 1 | 200 | West. | MW | 440 | 600 |
| 1 | 150 | Ideal | Syn. | 220 | 1200 |
| 1 | 125 | West. | CS | 440/2300 | 1800 |
| 1 | 125 | West. | Syn. (3 brg.) | 550 | 600 |
| 1 | 125 | Cent. | SC | 440 | 1800 |
| 1 | 100 | G.E. | K | 220/440 | 1200 |
| 1 | 100 | A.C. | Sl. Rg. | 440 | 720 |
| 1 | 100 | G.E. | IM | 440 | 600 |
| 2 | 100 | G.E. | Syn. | 440 | 300 |
| 1 | 75 | West. | CW | 440 | 1200 |
| 1 | 60 | West. | CW | 440 | 720 |
| 3 | 50 | A.C. | SC | 220 | 900 |
| 1 | 50 | West. | CS | 440 | 3600 |
| 1 | 50 | West. | CW | 220 | 900 |
| 2 | 50 | Cent. (new) | SC | 220 | 1200 |
| 1 | 40 | G.E. | MT536 | 440 | 900 |
| 1 | 30 | G.E. | MT532 | 440 | 900 |
| 2 | 25 | G.E. | MT332 | 440 | 900 |

## TURBO GENERATORS

1—750 KVA G.E. Extraction 3/60/2300 volt, 250 PIS, 80 lb. & 16 lb. Extr. Surface Condenser. New 1940.

1—625 KVA G.E.-Moore 3/60/2300/3600 RPM Non-Condensing 180 PSI 35 lb. B.P. New 1936.

1—500 KVA West. Non-Cond. 3/60/220/440, 150 PSI 10 lb. B.P.

3—300 KW West. Non-Cond. Direct Current, 250 volt, 150 lb. 10 lb. B.P. New 1938.

1—75 KW G.E. Non-Cond. D.C. 125 volt.

1—35 KW G.E. Non-Cond. D.C. 125 volt.

## AIR COMPRESSORS

1—12,000 CFM Ingersoll-Rand Turbo Compressor, 3.25# pressure, 250 HP, 3/60/440/3600 RPM.

1—8,000 CFM Cooper-Bessemer 150/440 PSI, direct motor 2700 HP syn. 3/60/2300 volt new.

1—1050 CFM Ingersoll-Rand ES1, 17¾x13, 50 lb. PSI, 275 RPM, V-belt.

1—880 CFM Worthington Syn. motor drive 150 H.P. 3/60/440/277 RPM, size 17x10½x12.

1—734 CFM Sullivan Angle Class W13, Single Stage 13x13x8, 60 lb., 300 RPM, V-belt, 100 HP.

2—528 CFM Chicago NSB, 100 lb., 285 RPM V-belt 14x12.

2—368 CFM Ingersoll ER-1, 285 RPM, 100 psi., 50 HP direct gear, M.D. 3/60/220.

1—360 CFM Schramm Vertical V belted on steel base, 75 HP motor 3/60/220

1—277 CFM Chicago PB4 Air Cooled 50 HP V-Belt Motor Drive.

1—254 CFM Chicago Pneumatic NSB-125# Belt Drive 40 H.P.

1—245 CFM Ing. Rand 10x10 ER-1, 125#.

1—215 CFM Penna. 3A 10x8, 50 lb.

2—173 CFM Ingersoll ER-1 9x8, 300 RPM, 100 LB., V-belt.

## CENTRIFUGAL PUMPS

| Q | GPM | TNH | Description | Size | HP | Speed |
|---|---|---|---|---|---|---|
| 2 | 10,000 | 260′ | LeCourtenay | 20″ | 624 | 870 |
| 2 | 10,000 | 100′ | LeCourtenay | 20″ | 330 | 870 |
| 1 | 10,000 | 114′ | De Laval | 18″ | 370 | 988 |
| 1 | 9,000 | 88′ | De Laval | 18″ | 250 | 870 |
| 2 | 8,150 | 132′ | LeCourtenay | 16″ | 350 | 1150 |
| 1 | 8,000 | 110′ | Worthington | 14″ | 500 | 1200 |
| 2 | 7,000 | 200′ | LeCourtenay | 16″ | 423 | 1000 |
| 2 | 6,500 | 100′ | Worthington | 14″ | 200 | 1200 |
| 1 | 6,000 | 110′ | Ingersoll-Rand | 12″ | 536 | 1200 |
| 2 | 5,000 | 125′ | Worthington | 14″ | 200 | 1200 |
| 1 | 4,000 | 110′ | Ingersoll-Rand | 12″ | 500 | 1200 |
| 1 | 3,500 | 47′ | Southwark | 12″ | 75 | 870 |
| 1 | 3,100 | 42′ | Worthington | 12″ | 50 | 1150 |
| 2 | 2,550 | 200′ | De Laval | 8″ | 200 | 1750 |
| 1 | 2,310 | 24′ | Worthington | 12″ | 20 | 860 |
| 2 | 1,700 | 95′ | De Laval | 10″ | 60 | 1750 |
| 1 | 1,500 | 231′ | Allis-Chalmers | 8″ | 150 | 1750 |
| 3 | 1,200 | 40′ | Worthington | 6″ | 15 | 1750 |
| 1 | 550 | 125′ | Lawrence | 4″ | 30 | 1750 |
| 1 | 350 | 65′ | Lawrence | 4″ | 10 | 1150 |
| 1 | 275 | 172′ | (new) Weil | 3″ | 20 | 1750 |
| 2 | 150 | 100′ | (unused) Worth. | 2″ | 10 | 1750 |
| 1 | 45 | 120′ | Gould | 1½″ | 3 | 3450 |
| 1 | 30 | 115′ | Worthington | 1½″ | 2 | 3450 |

## DIESEL GENERATORS

1—2500 KVA General Motors, complete plant, 3/60/2300 with 2300 to 230/460 transformers, cooling system, starting equipment, switchboard, can demonstrate on foundations. Immediately available.

1—225 KVA General Motors, Twin 671, 3/60/440. —New 1941.

"Everything from a Pulley to a Powerhouse"

SINCE 1915

THE O'BRIEN MACHINERY CO.

T.M. REGISTERED U.S. PATENT OFFICE

Cable Address: OBRIEN PHILA.

PHILADELPHIA'S LARGEST MACHINERY DEALERS AND EXPORTERS

1547 North Delaware Avenue • Philadelphia 25, Pa., USA — Bell Phone Garfield 6-1150

## 220/440 Volt, 60 cycle **SQUIRREL CAGE** open, 3 Phase

### GUARANTEED REBUILT

| QN. | HP | MAKE | TYPE | BEARING | SPEED |
|---|---|---|---|---|---|
| 1 | 200 | G.E. | IK | S.B. | 900 |
| 1 | 200 | G.E. | IK | S.B. | 720 |
| 1 | 150 | G.E. | IK | S.B. | 600 |
| 1 | 150 | G.E. | IK | S.B. | 514 |
| 1 | 150 | G.E. | IK | S.B. | 1800 |
| 2 | 125 | Kling | | S.B.* | 1800 |
| 1 | 100 | West. | MS | S.B. | 1200 |
| 1 | 100 | West. | CS | S.B. | 720 |
| 2 | 100 | G.E. | IK | S.B. | 720 |
| 1 | 100 | G.E. | KT-347 | S.B. | 1200 |
| 2 | 100 | G.E. | IK | S.B. | 900 |
| 1 | 100 | G.E. | IK | S.B. | 1800† |
| 3 | 100 | G.E. | IK | S.B. | 1800 |
| 1 | 100 | West. | CS-504 | S.B. | 1800 |
| 1 | 75 | G.E. | IK | S.B. | 600 |
| 2 | 75 | G.E. | IK | S.B. | 720 |
| 2 | 75 | West. | CS-725C | S.B. | 900 |
| 1 | 75 | G.E. | K-508 | S.B. | 1200 |
| 1 | 75 | G.E. | IK | S.B. | 900† |
| 2 | 75 | G.E. | IK | S.B. | 900 |
| 4 | 75 | West. | CS | S.B. | 1200 |
| 4 | 75 | G.E. | IK | S.B. | 1200 |
| 2 | 75 | F.M. | QS-445 | S.B. | 1800 |

* Splash proof † 2200 volt

| QN. | HP | MAKE | TYPE | BEARING | SPEED |
|---|---|---|---|---|---|
| 2 | 75 | G.E. | IK | S.B. | 1200 |
| 1 | 60 | G.E. | KT-346 | S.B. | 900 |
| 1 | 60 | G.E. | IK | S.B. | 1800 |
| 1 | 60 | F.M. | QS-444 | S.B. | 1800 |
| 1 | 60 | G.E. | KT-333 | S.B. | 1800 |
| 4 | 60 | G.E. | IK | S.B. | 1800 |
| 1 | 50 | G.E. | IK | S.B. | 600 |
| 3 | 50 | West. | CS | S.B. | 900 |
| 1 | 50 | G.E. | KT-342 | S.B. | 900 |
| 1 | 50 | G.E. | KT-342 | S.B. | 900† |
| 2 | 50 | West. | CS-445 | S.B. | 1200 |
| 1 | 50 | G.E. | KT-327 | S.B. | 1800 |
| 2 | 50 | G.E. | IK | S.B. | 1800† |
| 3 | 50 | G.E. | IK | S.B. | 1800 |
| 1 | 40 | G.E. | KT-542 | S.B. | 720 |
| 1 | 40 | F.M. | BH12D | S.B. | 900 |
| 1 | 40 | G.E. | KT-338 | S.B. | 900 |
| 1 | 40 | West. | CS | S.B. | 1200 |
| 2 | 40 | G.E. | IK | S.B. | 1800† |
| 2 | 40 | G.E. | IK | S.B. | 1800 |
| 1 | 35 | G.E. | IK | S.B. | 720 |
| 1 | 35 | Triumph | B12 | S.B. | 900 |
| 3 | 30 | G.E. | KT-312 | S.B. | 1800 |

| QN. | HP | MAKE | TYPE | BEARING | SPEED |
|---|---|---|---|---|---|
| 3 | 30 | G.E. | IK | S.B. | 1800 |
| 5 | 30 | West. | K-365 | S.B.* | 3600 |
| 1 | 25 | G.E. | IK | S.B. | 720 |
| 1 | 25 | F.M. | BI2P | S.B. | 720 |
| 1 | 25 | Century | SC-39 | S.B. | 1200 |
| 1 | 25 | F.M. | BH12A | S.B. | 1200 |
| 1 | 25 | Ideal | A 18 | S.B. | 1200 |
| 1 | 25 | West. | CS-471 | S.B. | 1800 |
| 1 | 20 | F.M. | KBV | S.B. | 1200 |
| 1 | 20 | G.E. | KT-322 | S.B. | 1200 |
| 1 | 20 | G.E. | KT-312 | S.B. | 1200 |
| 1 | 20 | G.E. | K-364 | S.B. | 1800 |
| 1 | 20 | West. | CS-364 | S.B. | 1800 |
| 2 | 20 | G.E. | K-326 | S.B. | 3600 |
| 4 | 20 | Line-Weld | Frame 326 | S.B. | 3600 |
| 2 | 15 | West. | CS | S.B. | 720 |
| 1 | 15 | Wagner | 15 T | S.B. | 1200 |
| 1 | 15 | Ideal | A | S.B. | 1200 |
| 1 | 15 | G.E. | KT-502 | S.B. | 1200 |
| 1 | 15 | G.E. | KT-752 | S.B. | 1800 |
| 1 | 10 | G.E. | IK | S.B. | 1200 |
| 1 | 10 | G.E. | KT-752 | S.B. | 1200 |

## SLIP RING MOTORS

**We offer from stock the following 220/440 volt, 60 cycle, 3 phase, GUARANTEED REBUILT equipment, unless otherwise noted.**

| QUAN. | H.P. | MAKE | TYPE | SPEED | DESCRIPTION |
|---|---|---|---|---|---|
| 1 | 15 | G.E. | MT 312 | 900 | S.B. |
| 1 | 30 | G.E. | MT 332 | 900 | |
| 1 | 50 | Al. Ch. | ANY | 600 | |
| 2 | 40 | Al. Ch. | ARY 444 | 1800 | splash proof, S.B. |
| 1 | 40 | G.E. | MT 336 | 900 | S.B. |
| 1 | 50 | G.E. | I-M | 900 | S.B. |
| 2 | 60 | G.E. | MT 556 | 600 | |
| 1 | 60 | G.E. | MT 348 | 900 | |
| 1 | 60 | G.E. | I-M | 900 | |
| 1 | 60 | West. | CW 505 | 1200 | |
| 1 | 75 | G.E. | I-M | 720 | |
| 1 | 100 | G.E. | I-M | 720 | |
| 1 | 100 | G.E. | I-M | 900 | |
| 1 | 125 | G.E. | I-M | 720 | |
| 1 | 150 | G.E. | I-M | 600 | |
| 1 | 150 | G.E. | I-M | 1800 | 2300 volt |
| 1 | 200 | G.E. | I-M | 600 | |

## TOTALLY ENCLOSED MOTORS

**FAN COOLED, BALL BEARING, 220/440 volt, 60 cycle, 3 phase, GUARANTEED REBUILT, unless otherwise noted.**

| QUAN. | H.P. | MAKE | MAKE | SPEED | DESCRIPTION |
|---|---|---|---|---|---|
| 1 | 7½ | G.E. | KF 284 | 1800 | |
| 1 | 7½ | Reliance | AA 324 | 1200 | XP, NEW |
| 3 | 10 | L.A. | JS 326 | 1200 | |
| 1 | 15 | West. | CS 326 | 1800 | XP, NEW |
| 1 | 25 | L.A. | JS 364 | 1800 | XP, NEW |
| 1 | 40 | G.E. | K 405 | 1800 | |
| 1 | 50 | Master | FB 404 | 3600 | XP, NEW |
| 1 | 50 | Al. Ch. | ARZZ 444 | 1800 | NEW |
| 1 | 75 | G.E. | K 505 | 1200 | |

# POWER EQUIPMENT COMPANY

**8 CAIRN STREET — P. O. BOX 534 — ROCHESTER 2, N. Y.**

**Telephone: Genesee 5629**



## MOTORS - M. G. SETS - COMPRESSORS, ETC.

### FAST SHIPMENT

**MOTOR GENERATOR SETS**
**3 Ph. 60 Cy.**

| KW | MAKE | RPM | D.C. VOLTS | A.C. VOLTS |
|---|---|---|---|---|
| 1250 | G.E. | 720 | 275 | 2200 |
| 750 | Al.-Ch. | 720 | 250 | 440 |
| 400 | West. | 720 | 550 | 2300 |
| 300 | G.E. | 1200 | 275 | 2300 |
| 300 | Ridg. | 1200 | 250 | 2300 |
| 300 | West. | 1200 | 550 | 4000/2300 |
| 200 | Ridg. | 900 | 250 | 2300 |
| 200 | West. | 1200 | 275 | 2300 |
| 200 | G.E. | 1200 | 275 | 2300 |
| 200 | G.E. | 1200 | 250 | 4000/2300 |
| 150 | Ridg. | 900 | 250 | 2300 |
| 100 | Ridg. | 1200 | 250 | 2300/440 |
| 75 | West. | 900 | 75 | 440/220 |
| 35 | G.E. | 1800 | 125 | 440/220 |

**ROTARY CONVERTERS**

| KW | MAKE | RPM | D.C. VOLTS | A.C. VOLTS |
|---|---|---|---|---|
| 500 | G.E. HCC6 | 1200 | 250 | 4000/2300 |
| 300 | G.E. HC12 | 600 | 250 | 4000/2300 |
| 300 | West. | 1200 | 250 | 4000/2300 |
| 300 | G.E. HCC6 | 1200 | 250 | 4000/2300 |
| 150 | G.E. HCC6 | 1200 | 250 | 4000/2300 |

**AIR COMPRESSORS**

356 CFM, Chg. Pr. 12"x10"—NSB 100 lbs.
500 CFM, 100#, Allis Rotary direct connected 100 H.P. B.B. Motors.

**A.C. MOTORS—3 Ph. 60 Cy.**

| HP | MAKE | RPM | TYPE |
|---|---|---|---|
| 1200 | G.E. | 277 | MT—S.R. |
| 400 | G.E. | 450 | MT—S.R. |
| 300 | G.E. | 450 | IM—SI.Rg. |
| 160 | G.E. | 600 | IK-16—Sq. Cg. |
| 150 | West. | 514 | CS954—Sq. Cg. |
| 150 | G.E. | 600 | ATI—Syn. |
| 100 (2) | Allis | 720 | ARX—Sq. Cg. |
| 100 | West. | 900 | Syn. |
| 100 | West. | 1200 | CS752C—Sq. Cg. |
| 100 | G.E. | 1750 | KT—Sq. Cag. |
| 100 (2) | G.E. | 450 | IM16—SI.Rg. |
| 75 | West. | 900 | CS—Sq. Cg. |
| 75 | G.E. | 600 | ITC5031A |
| 60 | West. (2200V.) | 600 | CW—S.R. |
| 50 (2) | G.E. (2200V.) | 1750 | KT—Sq. Cg. |
| 50 | West. | 1750 | CS |
| 50 (2) | G.E. | 1750 | KT—Sq. Cg. |
| 50/12.5 | G.E. | 900/450 | IM 2200 v. |
| 40 | G.E. | 900 | MT—SI. Rg. |
| 40 | West. | 900 | CS—Sq. Cg. |

Also Smaller Units in Stock

**TRANSFORMERS—1 Ph. 60 Cy.**

| KVA | MAKE | PRI. | SEC. |
|---|---|---|---|
| 1—3000 (3 Ph) | G.E. Auto | 25000 | 22000 |
| 3—500 | West. | 22000 | 2200 |
| 3— 50 | West. | 2200 | 220/110 |

Also Smaller Units in Stock

## MOORHEAD ELECTRICAL MACHINERY COMPANY

361 Noblestown Road — Oakdale, Penna. — Pittsburgh District



COMPRESSOR: Worthington 2 stage, 29/18-½x 21, 600 H.P. synchronous motor, 3 phase, 60 cycle, 440 volts, 180 RPM, 100 lbs. pressure, 3000 CFM, complete with auxiliary equipment. In operation now, available immediately.

DIESEL MOTOR: 122 H.P. Caterpillar D13000 complete with clutch, V-belt pulley, and spare parts.

DRAG SCRAPERS, CRESCENT BUCKETS: 1—Sauerman 2 yd. Drag Scraper outfit complete, without 75 H.P. motor. 1—Sauerman ¾ yd. capacity complete with 30 H.P. motor. 1—Sauerman 1 yd. capacity complete with diesel motor.

BOILERS: 1—Erie City 150 H.P., ASME, return H.P., 160 lbs. pressure, National Board, 3 sure, pin hole grates and all fittings. 2—220 H.P., 160 lbs. pressure, National Board, 3 drum, low head, complete.

## A. J. O'NEILL

**Lansdowne, Pa.**

**Phila. Ph.: Madison 3-8300—3-8301**



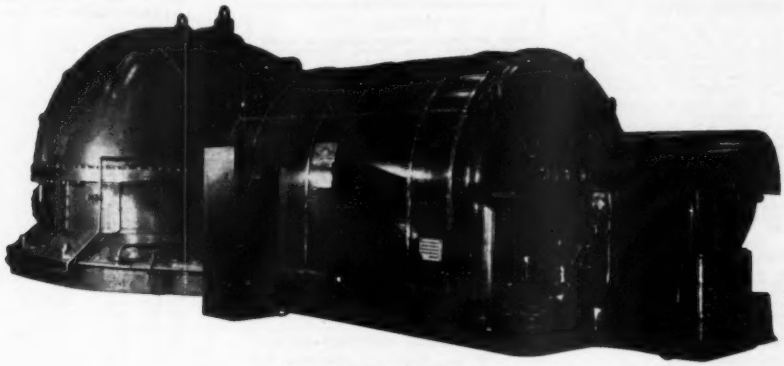
**TEMPERATURE RECORDERS**

27—Used Leeds and Northrup Indicating and Recording Micromax Recorders Model "B" Automatic motor driver self-contained flush mounting.

**DALTON SUPPLY CO.**

2829 Cedar St. Phila. 34, Pa. GArfield 6-1300

**25,000 KVA—20,000 KW, 80% P.F., 3 phase 60 cycle, 13,200 volts, 1800 RPM General Electric Company condensing turbine generator unit 215 P.S.I.G. 540-550° total temperature complete with direct connected shaft exciter, switchboard and instruments, a 30,000 square foot 2-pass Westinghouse surface condenser, motor driven and turbine driven pumps and condensing accessories.**



ACTUAL PHOTOGRAPHIC VIEW

## *EXCELLENT CONDITION — COMPLETE INSTALLATION — PROMPT DELIVERY*

### TURBINE-GENERATOR UNITS

*3 phase, 60 cycle*

6250 KVA G.E. condens., 3-stage, 2300/4000 volts, 200# P.S.I., 600°TT.
4000 KVA Allis condensing 2300 volts, 150-200 PSI.
3750 KVA Allis condensing 2300 volts 125 to 175 PSI.
2500 KVA G.E. Type ATB, Form HT, 2300/480 volts, 3600 RPM, two bearing alternating current generator LESS TURBINE.
2500 KVA G.E. condensing 200 P.S.I. 2400 volts.
1875 KVA Westinghouse condensing, 2300 volts, 250# PSI.
1563 KVA Allis condensing 600 volts, 200 PSI.
1563 KVA G.E. condensing 2300 volts 225 PSI.
780 KVA Allis condensing, 150 PSI, 480 volts.
740 KVA Allis non-condensing 2300/480 volts, 150 PSI, 12# back.
625 KVA G.E. condensing 150 PSI 480 volts.
625 KVA G.E. non-condensing 150 P.S.I., 20# back, 480 volts.
125 KVA G.E. non-condensing, 150-200 P.S.I., 2300 volts.
125 KVA Westghse. non-condensing 150/250 P.S.I., 2400 volts.

*Direct Current*

300 KW Westghse. 3-wire, 250 volt 150/250# P.S.I. non-condensing.
150 KW (2) Westinghouse-Worthington, 250 volts, 3-wire, 225-250 P.S.I. condensing.
100 KW (2) G.E. 125 volt, 200/275 P.S.I. non-condensing
75 KW (2) Westinghouse-Moore, 120 volt, 200# P.S.I. condensing.
60 KW (3) new Westinghouse, 120 volt, 200# P.S.I. condensing.

### MOTOR GENERATOR SETS

100 KVA Westghse, 60 cycle, 2400 volts, 900 RPM alternator direct connected 135 HP, 250 volt direct current motor.
62½ KVA G.E., 60 cycle, 2300 volt alternator to 75 HP, 125 volt DC motor.
10 KW G.E. 125 volts direct current to 12 HP 60 cycle, 220 volt motor.

### SYNCHRONOUS MOTORS

*3 phase, 60 cycle*

5000 KVA Westinghouse, 4000 volt, 720 RPM Electrical Syn. (condenser).
900 HP Allis, 2200 volts, 150 RPM.
300 HP G.E., 80% P.F., 2300 volts, 720 RPM.

***AUGUST BARGAINS***
***SPECIALLY PRICED***

2—Elliott Company twin-strainers mounted on factory bedplate to a 25 HP, 3 phase 60 cycle, 220/440 volts 1170 RPM General Electric totally enclosed fan cooled motor with miscellaneous piping and valves, practically new.
1—4400 sq. ft. Worthington surface condenser.
2—1000 GPM, 1270 foot head, 4-stage Morris pumps each connected 417 HP, 390# P.S.I. non-cond. G.E. turbine.
1—G.E. Bank of Scott connected 2 to 3 phase, 60 cycle transformers, 2500 KVA capacity.
1—20 KW 125 volt direct current generator connected Hill Diesel engine.

### UNAFLOW GENERATOR UNITS

*Alternating Current—3 phase, 60 cycle*

750 KVA G.E. 2300/440 volt generator direct connected Skinner non-condensing engine.
500 KVA G.E., 2400/480/240 volts generator connected Ames Vertical Engine, 150#.
375 KVA G.E., 2300/440 volts generator connected 23"x24" Skinner Horizontal Engine.
175 KVA Westghse., 240 volt generator connected Skinner Horizontal Engine, 125-150# P.S.I., 5# gauge back.

*Direct Current*

400 KW G.E. 250 volts, 360 RPM generator connected Skinner vertical engine 150#.
300 KW Burke 250 volt generator connected Skinner horizontal engine 125#.
250 KW Crocker Wheeler 125 volt generator direct connected Ames Vertical non-condensing engine 150#.
250 KW (2) G.E., 3-wire, 250 volts generators connected Skinner engines, 150#.
25 KW (2) Allis 250 volt, 500 RPM generators each direct connected American Blower vertical engine 125/150#.
15 KW, 120 volt generator connected Troy Engberg engine 125#.

**UMC UTILITIES MACHINERY CORP.**
**1965 EAST 6th STREET • CLEVELAND 14, OHIO • Long Distance 422**

# BREW-WOLTMAN OFFERS

### TURBINE UNITS

1—15630 KVA G.E. Cond. 60 cy. 13200 V. 275#
1—12500 KVA Allis Cond. 60 cy. 13800 V. 300-lb.
1—10000 KVA G.E. Cond. 25 cy. 6600 V. 200-lb.
1—6250 KVA Allis Cond 60 cy. 4000 V. 175-200-lb.
1—5000 KVA West. Extr. Cond. 60 cy. 480 V. 385-lb.
1—3750 KVA G.E. Cond. 60 cy. 2300 V. 185-lb.
1—2500 KVA Worthington Non-C. 60 cy. 2300 V. 150-200-lb. 40-lb. BP
1—2500 KVA G.E. Extr. Cond. 60 cy. 480 V. 185-200-lb. steel valve chest.
2—2250 KVA G.E. Cond. 60 cy. 240-400-lb.
1—1875 KVA G.E. Cond. 2300 V. 60 cy. 100-lb.
1—1563 KVA G.E. Cond. Extr. 60 cy. 2300 V. 200-lb.
1—1250 KVA Allis Cond. 60 cy. 2300 V. 150-200-lb.
1—938 KVA G.E. Extr. Cond. 60 cy. 240 V. 200-lb.
1—750 KVA G.E. Extr. Cond. 60 cy. 480 V. 200-lb.
1—625 KVA G.E. Non-C. 60 cy. 2300 V. 150-lb. 35-lb. BP
1—625 KVA West. Cond. 60 cy. 480 V. 150-lb.
2—250 KVA Elliott Non-C. 60 cy. 208 V. 200-lb. 5-lb. BP

### DIESEL ENGINE UNITS

1—1600 HP Fair. Morse 2300/4150 V. 60 cy.
1—1000 HP Superior 2300 V. 60 cy.
1—900 HP Amer. Loco. 250 V. DC
1—630 HP Amer. Loco. 440 V. 60 cy.
1—250 HP Buckeye 240 V. 60 cy.

### STEAM ENGINE UNITS

1—312 KVA Skinner Uniflow 480 V.
1—250 KVA Ames Vertical Uniflow 480 V.
2—167 KVA Ames Vertical Uniflow 240/480 V.
1—150 KVA Ames Vertical Uniflow 240 V.

### ROTARIES—60 CY.

| QU. | KW | MFR. | VOLTS-DC | TRANS. | RPM |
|---|---|---|---|---|---|
| 1 | 3250 | G.E. | 225/285 | 13800 | 300 |
| 1 | 2906 | A.C. | 600 | 4150 | 514 |
| 2 | 1000 | West. | 600 | 4150 | 720 |
| 3 | 1000 | G.E. | 600 | 13200 | 900 Auto. |

### SYNCHRONOUS CONDENSERS

| QU. | KVA | MFR. | VOLTAGE | RPM |
|---|---|---|---|---|
| 1 | 2500 | G.E. | 2400/4160 | 720 |
| 1 | 2000 | West. | 2300 | 720 |
| 1 | 1500 | G.E. | 4600 | 900 |
| 1 | 1500 | West. | 2300 | 900 |

### SPECIAL

1—150 HP General Electric synchronous cubicle motor starter, type CR-7811, across-the-line, reversing dynamic breaking.

### MERCURY ARC RECTIFIERS

| QU. | KW | KIND | DC VOLTS | TRANS. |
|---|---|---|---|---|
| 2 | 4500 | Multi Anode | 600 | 13800 |
| 4 | 3250 | Ignitron | 650 | 33000 |
| 2 | 1850 | Ignitron | 360 | 33000 |
| 1 | 1000 | Ignitron | 600 | 13800 |

### MOTOR GENERATOR SETS—60 CY.

| QU. | KW | MFR. | VOLTS-D.C. | A.C. | RPM |
|---|---|---|---|---|---|
| 2 | 1500 | G.E. | 600 | 13200 | 720 |
| 1 | 1500 | G.E. | 250 | 2200 | 514 |
| 1 | 1000 | G.E. | 600 | 13200 | 514 |
| 1 | 750 | A.C. | 275 | 440 | 720 |
| 1 | 750 | A.C. | 250 | 2300 | 514 |
| 1 | 500 | West. | 125 | 2300 | 720 |
| 1 | 400 | G.E. | 250 | 5000 | 720 |
| 1 | 75 | West. | 125 | 440 | 1200 |

### SYNCHRONOUS MOTORS—60 CY.

| QU. | HP | MFR. | VOLTAGE | RPM |
|---|---|---|---|---|
| 1 | 4350 | Cr. Wh. | 13800 | 514 |
| 2 | 700 | West. | 2300 | 200 |
| 1 | 600 | G.E. | 440 | 360 |
| 2 | 350 | G.E. | 2300 | 257 |
| 1 | 300 | G.E. | 2300 | 600 |
| 1 | 300 | West. | 2300 | 900 |

### FREQUENCY CHANGERS

| QU. | KVA | MFR. | CYCLES | RPM |
|---|---|---|---|---|
| 1 | 3125 | G.E. | 25/60 | 300 |
| 1 | 3000 | G.E. | 60/25 | 300 |
| 2 | 2500 | G.E. | 25/62½ | 750 |
| 1 | 2450 | G.E. | 62½/25 | 750 |
| 1 | 1250 | G.E. | 25/60 | 300 |
| 1 | 1250 | West. | 25/60 | 300 |
| 1 | 500 | A.C. | 25/60 | 300 |

### TRANSFORMERS—60 CY.

1— 7500 KVA G.E. 138000—41000, 3 ph.
3— 3333 KVA West. 132000—7020/13200 Y
1— 2000 KVA G.E. 69000—13800/23900, 3 ph.
3— 1000 KVA West. 66000—7200
3— 500 KVA G.E. 66000—2400
1— 2500 KVA G.E. 39/73 KV—5 taps, 3 ph.
3— 200 KVA Mel. 44000/22000—440/220
3— 75 KVA G.E. 44000—2300/4000
3— 8333 KVA West. 43800—13800
3— 100 KVA Wag. 36000—7200/12470 Y
1— 18750 KVA A.E.E. 34840—11000, 3 ph.
2— 7500 KVA Al. Ch. 33000—13800, 3 ph.
3— 200 KVA Wag. 33000—7200
6— 200 KVA G.E. 33000—2300/6900
6— 167 KVA G.E. 33000—2300/4000 Y
6— 150 KVA G.E. 345000—2300/4000
6— 150 KVA G.E. 33000—7200/12470
6— 75 KVA Mel. 33000/18500—2300/5900
3— 75 KVA Wag. 33000—7200/12470 Y
6— 50 KVA G.E. 33000—2300
1— 7500 KVA G.E. 26400—612, Rectifier Type
4— 450 KVA Al. Ch. 25410/44000—13280/23000
1— 3000 KVA G.E. 22000—480, 3 ph.
1— 2000 KVA G.E. 22000/11000—2300, 3 ph.
1— 1000 KVA G.E. 22000/11000—2300, 3 ph.
3— 833 KVA G.E. 22000—480
3— 333 KVA G.E. 22000/11000—2400
2— 750 KVA Wag. 19050/33000 Y—6800/11950
2— 200 KVA G.E. 11500—220/110
3— 200 KVA Mel. 11000—2300
3— 833 KVA G.E. 7620/13200 Y—2300
3— 37½ KVA Pitts. 6900—230/460
1— 500 KVA G.E. 4000—2300
1— 200 KVA West. 2400—120/240/480
1— 200 KVA A.C. 2400—120/240
1— 150 KVA G.E. 2400—240/480
1— 100 KVA Kuhl. 550—20/110
12— 15 KVA Stand. 480/25—117/234

### OIL CIRCUIT BREAKERS

4—800 A. 154 KV G.E. FHKO-39-2500 Outdoor
1—600 A. 132 KV G.E. FHKO-86-1500 Outdoor
2—600 A. 73 KV G.E. FHKO-139-1000 Outdoor
1—400 A. 73 KV G.E. FHKO-236-500 Outdoor
1—600 A. 37 KV G.E. FHKO-139-450 Outdoor
1—400 A. 37 KV G.E. FHKO-236-500 Outdoor
1—400 A. 37 KV Condit FO-48-B-750 Outdoor
4—600 A. 15 KV G.E. FHKO-139-750 Outdoor

*PARTIAL LIST—WE HAVE ALL CLASSES OF POWER EQUIPMENT*

## BREW, WOLTMAN & CO., INC.

50 Church Street — New York City 7, — WOrth 4-1470

### FOR SALE

## 6 OIL FIRED B&W BOILERS

Heating Surface ..... 11417 Square Feet
Horse Power ..... 1141.7
Design Pressure ..... 200 P.S.I.G.
Working Pressure ..... 200 P.S.I.G.
Capacity—Normal ..... 75,000 lbs./hr.
Steam Temperature ..... Saturated
Furnace Volume ..... 1024 Cubic Feet
Feed Water Temperature ..... 200°
Tubes ..... 1¼" bent—825
1¼" str. —1667—12'2" long
2" straight — 122—12'2" long
3¼"str. — 16
First 2 rows of Tubes above fire box are 2"
Downcomer & Uptake Tubes ..... 4" & 4½" bent
Oil Burners per Boiler ..... 8
Boiler Dimensions ..... Width—19'4"
Height—16'4½"
Water Wall Sides in Furnace — Depth—15'

The above units presently aboard S.S. George Washington. Installed new 1943.

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## The BOSTON METALS Co.

313 E. Baltimore St. — Baltimore 2, Md.

CURTIS 5050-5051

### FOR SALE

COMPLETE

## STEAM POWER PLANT

5—714 HP Combustion Engineering WATER TUBE BOILERS, with Ebasco Superheaters, Sturtevant High Pressure Economizers, Green Chain Grate Stokers, Hagan Combustion Controls, Copes Feed Water Regulators, Clarage Forced Draft Fans, with Hoppers, Automatic Coal Conveyors, Automatic Ash Conveyor, 36" x 24" Jeffrey Flex-Tooth Coal Crusher.

1—705 HP Stirling 4 dum BOILER with B&W U-type superheater.

1—10,000 KW Allis-Chalmers STEAM TURBINE.

1—7,500 KW Allis-Chalmers STEAM TURBINE.

1—7,500 KW General Electric STEAM TURBINE.

*All with complete control equipment.*

*Send for complete Inventory in Denver.*

## MORSE BROS. MACHINERY COMPANY

2700 BRIGHTON BLVD.
BOX 1708 — DENVER 1, COLORADO

# POWER EQUIPMENT—READY TO SHIP

## A.C. MOTORS
**220/440 volt 3 ph. 60 cy.**

| HP | Make | RPM | Type |
|---|---|---|---|
| 250 | Gen. Elec. | 515 | KP575 TEFC |
| 250 | Gen. Elec. (Vert.) | 1200 | 2200 V. |
| 250 | Gen. Elec. | 1200 | I-E1sA |
| 250(4) | Westinghouse | 1775 | 2300 V. |
| 200 | Gen. Elec. | 880 | CS 8758 |
| 200 | Gen. Elec. | 450 | 2300 V. |
| 200(5) | Wagner | 1750 | KF576 TEFC |
| 200 | Gen. Elec. | 1800 | BP-3 |
| 175 | West. | 600 | Syn. 2200 V. |
| 175 | West. | 1200 | CS945A |
| 150 | Gen. Elec. | 450 | MS Hi Torq |
| 150 | West. | 600 | TEFC |
| 150(4) | West. | 1150 | Syn. |
| 150 | West. | 1200 | CS875S |
| 125 | Elec. Mach. | 164 | MS Hi Torq |
| 125(3) | West. NEW | 1200 | Syn. |
| 100 | Fair. Morse | 360 | Syn. |
| 75 | Stanley | 600 | — |
| 75 | Elec. Mach. | 900 | Syn. |
| 75 | Allis Chalmers | 1750 | 2200 V. |
| 75 | Louis Allis | 1800 | FX-505S |
| 60 | Gen. Elec. | 1200 | KT-533 |
| 60 | Triumph | 1200 | B-183 |
| 50 | Crocker Wheeler | 900 | — |
| 50(3) | West. | 900 | CS |
| 50(3) | West. | 1200 | CS |
| 50(2) | Reliance NEW | 1780 | 2200 or 550 V. |
| 50(3) | Gen. Elec. NEW | 1750 | 2200 or 550 V. |
| 49 | Gen. Elec. | 870 | KT-546 |
| 40(3) | West. | 720 | CS |
| 40 | Crocker Wheeler | 720 | — |
| 40(4) | Fair. Morse | 1200 | H-12B |
| 40 | Gen. Elec. | 1630 | KR-444 |
| 40 | Allis Chalmers | 1750 | TEFC Hi Torq |
| 40 | Gen. Elec. | 3600 | FT |
| 35(3) | Onan | 1800 | Syn. |
| 30 | Louis Allis NEW | 1800/1200 | Frame 445 |
| 30 | Gen. Elec. | 720 | KR-444 TEFC |
| 30 | Fair. Morse | 900 | H |
| 30(5) | Allis Chalmers | 1750 | — |
| 30(3) | Gen. Elec. | 3600 | KT-206 |
| 25 | Commonwealth | 560 | — |
| 25/7.5 | Continental | 1150/575 | A-68X |
| 25/6.2 | Continental | 1150/570 | Linestart |
| 25 | Gen. Elec. | 1200 | KF-405 |
| 25 | West. | 1200 | CS-405 |
| 25(2) | West. | 1800 | CS |
| 20 | Gen. Elec. | 680 | KT-532B |
| 20/7½ | Gen. Elec. | 1165/425 | K-504 |
| 20 | Allis Chalmers | 850 | — |
| 20 | Louis Allis | 870 | Exp. Proof |
| 20(6) | Allis Chalmers | 1150 | — |
| 20 | Gen. Elec. | 1170 | 2200 V. |
| 20(3) | Gen. Elec. | 1760 | K-364 |
| 15 | Gen. Elec. | 570 | KT-326 |
| 15 | Gen. Elec. | 960 | IK |
| 15 | West. | 850 | CS |
| 15 | Louis Allis | 1750/566 | FX-365Y |
| 15 | Louis Allis | 1150/1740 | — |
| 15 | Gen. Elec. | 3600 | KT-952 |
| 10 | American | 1150 | TEFC |

## SLIP RING MOTORS
**3 ph.—60 cy.**

| HP | Make | RPM | Volts |
|---|---|---|---|
| 400 | Westinghouse | 435 | 2300 |
| 350 | Westinghouse | 330 | 2300 |
| 200 | Westinghouse | 900 | 220/440 |
| 100 | Triumph | 580 | 220/440 |
| 75 | General Electric | 600 | 220/440 |
| 75 | General Electric | 450 | 220/440 |
| 60 | General Electric | 570 | 220/440 |
| 60 | Burke | 1200 | 220/440 |
| 50 | General Electric | 870 | 220/440 |
| 50 | Allis Chalmers | 690 | 220/440 |
| 50 | General Electric | 900 | 220/440 |
| 50 | General Electric | 1200 | 220/440 |
| 35 | Westinghouse | 900 | 220/440 |
| 30 | Allis Chalmers | 575 | 220/440 |
| 25 | Westinghouse | 570 | 220/440 |
| 25 | General Electric | 1150 | 220/440 |

## SPECIAL BARGAINS
**Diesel Engine Generator Sets**

10—100 kw., 128/240 v. D.C. Delco Generators dir. con. to 150 HP Model GBD-6, 6¼x7, 6 cyl. Superior DIESEL Engines, elec. start with engine panels

4—100 KW same as above with 220 or 440 v. NEW A.C. Generators

1—UNUSED 62½ kva. 220/440 v. 3 ph. 60 cy. West. A.C. Generator with exciter dir. con. to 100 HP, 6 cy. UD-18 International Harvester Diesel Engine with panel.

10—Unused 37½ kva. 3 ph 60 cy. 127/220 v. or 220/440 v. 1200 rpm., Century A.C. Generators with dir. con. exciters driven by 70 HP., 4 cyl. Model UD-14 International Harvester DIESEL Engines with panels.

1—Unused 37½ kva., 3 ph. 60 cy. 127/220 v. or 220/440 v. Century 1800 rpm., dir. con. exciter driven by 72 HP., Model 6DTG317, Buda Diesel Engine with panel.

1—96 kva. Fairbanks Morse 220/440 v. 3 ph. 60 cy. 360 rpm DIESEL

4—25 kva. 120 v. 1 ph. 60 cy. Westinghouse dir. con. to 36 HP., 4 cyl. 900 rpm., LoNel Gasoline Engines with control panels.

3—25 kw., 220/440 v. 3 ph. 60 cy. Westinghouse direct connected to 4 cyl. LoNel Gasoline valve in head liquid cooled Engine complete with control panels

## CRANES

1 ton Euclid Overhead 29'6¼" span, 8' lift, 220/440 v. 3 ph. 60 cy.

1 ton Euclid Overhead 29'10½" span, 8' lift, 220/440 v. 3 ph. 60 cy.

## GEARHEAD MOTOR

1—NEW 10 Hp., Westinghouse 880 v. 3 ph. 60 cy. 900 rpm., to 10 rpm type FD-2282, frame WZ26 type CS

## VARIABLE SPEED MOTORS
**230 Volt D.C.**

| HP | Speed | Make | Type |
|---|---|---|---|
| 100 | 500/1000 | Westinghouse | SK-190 |
| 100 | 625/1250 | Westinghouse | S-18 L |
| 75 | 600/1200 | Westinghouse | — |
| 50 | 300/1200 | Crocker Wheeler | CMC |
| 40 | 385/1200 | Elec. | — |
| 40 | 250/1000 | Westinghouse | SK-141 |
| 35 | 350/1400 | General Electric | RPI6A |
| 25 | 300/1200 | General Electric | CD-130 |
| 25 | 325/975 | Westinghouse | — |
| 25 | 500/1500 | Westinghouse | SK-116L |
| 20 | 400/1600 | Westinghouse | SK-123 |
| 20(3) | 500/1500 | Westinghouse | SK-110L |
| 15(3) | 400/1600 | Westinghouse | SK |
| 10(3) | 500/2000 | Westinghouse | SK-103 |
| 10(6) | 400/1600 | General Electric | — |
| 5(6) | 400/1600 | Westinghouse | SK-70 |

## MOTOR GENERATOR SETS—
**250 V. D.C.**
**Motors 220/440 volt or 2200 volt**

| No. | KW | Make | Rpm |
|---|---|---|---|
| 2 | 200 | Westinghouse | 1200 |
| 1 | 100 | Westinghouse | 720 |
| 1 | 100 | General Electric | 900 |
| 1 | 100 | Westinghouse | 600 |
| 1 | 100 | General Electric | 1200 |
| 1 | 100 | Reliance | 850 |
| 1 | 100 | Delco | 1200 |

## TRANSFORMERS
**1 ph. 60 cy.**

| No. | Kva | Make | Primary | Sec. |
|---|---|---|---|---|
| 3 | 500 | West. | 22000 | 2300 |
| 3 | 300 | Pgh. | 23000 | 2300 |
| 3 | 200 | Pgh. | 4600 | 120/240 |
| 5 | 200 | Allis Chal. | 4800 | 120/240 |
| 2 | 150 | Pgh. | 4600 | 115/230 |
| 1 | 110 | Pgh. | 4600 | 115/230 |
| 6 | 100 | Pgh. | 4600 | 115/230 |
| 2 | 100 | Allis Chal. | 4800 | 120/240 |
| 1 | 100 | G.E. | 4800 | 120/240 |
| 1 | 75 | Pgh. | 4600 | 115/230 |

## BAKER LOCOMOTIVE CRANE TRUCK

Model CYA 3000 lbs. at 7' radius with 5 to 12' adjustable telescoping boom complete with slow control, hoist control and boom control.

***WRITE, WIRE OR PHONE YOUR ELECTRIC NEEDS—SEND FOR STOCK LIST. LIST YOUR IDLE EQUIPMENT WITH US.***

## Duquesne Electric & Mfg. Co. Pittsburgh 6, Pa.

## FOR IMMEDIATE SALE AND SHIPMENT

1—Murray 510 HP Cross Drum Water Tube Boiler, ASME; built for 225# pressure in 1946; fired for two years. With American Perfect stokers, Thermix stack, Hays combustion control, valves, piping, etc. etc.

1—750 KVA Uniflow Engine Generator Set; G.E. Generator, 600 kw, 3/60/2300 v. 80% PF; 150 rpm, Filer and Stowell 26x36 non-condensing Uniflow engine, 175# steam, 10# back pressure.

**CONSOLIDATED PRODUCTS CO. Inc.**
14-17 Park Row, New York City
BArclay 7-0600

## COMPLETE DIESEL PLANT

3—575 HP F.M. 5 cylinder, 400 RPM. 383 KW F.M. 3/60/2300 alternators. Woodward governors, heat exchangers and complete plant auxiliaries. For sale in whole or part. Condition excellent.

**MISSISSIPPI VALLEY EQUIPMENT CO.**
507 Locust St. St. Louis 1, Mo.

*IN STOCK FOR IMMEDIATE SHIPMENT*

## NEW and REBUILT MOTORS

**3 PHASE, 60 CYCLE, 220 or 440 VOLTS UNLESS OTHERWISE NOTED**

| HP | MFG. | RPM | TYPE |
|---|---|---|---|
| 1000 | GE | 1200 | IM-2300 v* |
| 700 | West | 300 | CW-2300 v* |
| 600† | GE | 750 | IM-2200 v* |
| 400 | Cont | 1200 | NZ 800 |
| 200 | GE | 600 | IM-2300 v* |
| 200 | GE | 600 | KT-2200 v* |
| 200 | GE | 1200 | IM-220 v* |
| 150 | GE | 514 | KT 566 |
| 150 | GE | 3600 | TEFC |
| 125 | West | 180 | HR-2200 v** |
| 125 | GE | 450 | KT |
| 125† | GE | 750 | IK-15, 2200v |
| 100† | GE | 750 | IM-2200 v* |
| 100 | Ideal | 1200 | FRS** |
| 100 | GE | 1200 | K6323S, TEFC‡ |
| 75 | Ridge. | 720 | * |
| 60 | Linc. | 900 | IXM* |
| 60 | GE | 1200 | MT 546* |
| 60 | West | 1800 | 445, BB |
| 50 | West | 900 | CS 946 C |
| 50 | A-C | 900 | ARZT, TEFC |
| 50 | GE | 900 | KG 504 (4)‡ |
| 50 | GE | 1200 | KG 445 (2)‡ |
| 50 | West | 3600 | CS 405 |
| 40 | A-C | 720 | 505, TEFC |
| 40 | GE | 900 | KG 445 (2)‡ |
| 40 | GE | 900 | KT 342 |
| 40 | A-C | 900 | TEFC |
| 40 | GE | 1200 | KT |
| 40 | GE | 1200 | TEFC-XP |
| 40 | West | 1800 | CS |
| 30 | West | 1200 | CS 567 C |
| 30 | GE | 1200 | 445, XP |
| 30 | GE | 1800 | K 365 |
| 30 | West | 1800 | CS 405 |
| 25 | GE | 1200 | FT 522 |
| 25 | West | 1200 | CS 556 C |
| 25 | GE | 1800 | FT 509 |
| 20 | West | 1800 | CS 364 |
| 20 | GE | 900 | MT 522* |
| 20 | Delco | 1200 | TEFC |
| 15 | GE | 720 | KT |
| 15† | GE | 750 | K 405 |
| 15 | GE | 1200 | KT 362 |
| 15 | GE | 900 | K 365 |
| 15 | Baldor | 1200 | TEFC |
| 15† | GE | 1500 | KT 312 |
| 15 | GE | 1800 | K 326 |
| 15 | GE | 3600 | KF 324 |
| 10 | GE | 900 | KG, TEFC |
| 10 | GE | 1200 | XP-Brake |
| 10 | L-A | 1200 | OGA (7)‡ |
| 10† | GE | 1500 | K 264 |
| 7½ | GE | 720 | K 326 |
| 7½ | GE | 900 | K, TEFC |
| 7½ | GE | 1200 | KG 324‡ |
| 7½ | GE | 1800 | K 284 |
| 5 | GE | 720 | KT 302 |
| 5† | GE | 750 | K 324 |
| 5 | GE | 900 | MTC 5044* |
| 5 | L-A | 900 | OGX324(9)‡ |
| 5 | GE | 1200 | K 284, spl |
| 5 | L-A | 1200 | OGX 284 |
| 5 | Cent | 1800 | TEFC-XP |
| 5 | GE | 1800 | K 254 |
| 5 | GE | 3600 | TEFC-XP |
| 3 | GE | 1200 | K 254 (3) |
| 3† | Master | 1500 | TEFC |
| 3 | GE | 1800 | TEFC |

* slip-ring ** synchronous † 25 cy. ‡ New

***WRITE, WIRE, OR PHONE YOUR REQUIREMENTS***
***THIS IS A PARTIAL LISTING • WE PAY CASH FOR YOUR SURPLUS***

## PREFERRED *Electric Motors Inc.*

230 HUDSON AVE., P.O. BOX 767 • ROCHESTER 3, NEW YORK

# This Seal ...tells you what you buy is GOOD EQUIPMENT!

GUARANTEED GOOD BECAUSE REBUILT AND TESTED UNDER SUPERVISION OF

## HEMPHILL ELECTRICAL ENGINEERS

**TRANSFORMERS—60 Cycle**

| Qu. | KVA | MAKE | TYPE | Ph. | VOLTAGES |
|---|---|---|---|---|---|
| 1 | 1500 | GE | Pyranol | 3 | 4150x2200V |
| 1 | 500 | Kuhl. | OISC | 1 | 4600x2300V |
| 3 | 400 | GE | H | 1 | 6900x2250V |
| 1 | 300 | Pitts. | ODSC | 1 | 7800x440V |
| 1 | 200 | GE | HT | 3 | 2300x220 |
| 1 | 200 | Whse. | Auto | 2/3 | 4150x2300 |
| 1 | 200 | Pitts. | OISC | 1 | 4000x110/220 |
| 1 | 200 | GE | Auto | 2/3 | 4150x2400 |
| 1 | 150 | GE | HT | 3 | 4150-120/208Y new |
| 1 | 150 | GE | Ks | 1 | 2300x230 |
| 1 | 100 | Pitts. | | 1 | 2750x110/220 |
| 3 | 100 | Wagner | RCKV | 1 | 240x120/120 |
| 2 | 100 | Whse. | SK | 1 | 4400x220/440 Taps |
| 2 | 100 | Newark | Dry | 2/2 | 440x220 |
| 2 | 50 | Whse. | Interteen | 1 | 2400x120/240 |

**SPECIAL—WELDING MOTOR GENERATOR SET**

1—176 KVA Whse. Welding Gen. Set, 1 Ph. 220V, 800 Amp 37% PF with Slip Ring Motor & Exciter

**MOTOR GENERATOR SETS**
**3 Phase, 60 Cycle**

| Qu. | KW | MAKE | SPEED | DC | AC |
|---|---|---|---|---|---|
| 1 | 1600 | GE | 514 | 600 | 2300/4150 Syn. |
| 1 | 300 | GE | 1200 | 250 | 2300 Syn. |
| 2 | 200 | Whse. | 900 | 250 | 220/440 Syn. |
| 1 | 150 | GE | 1200 | 125/ 250 | 2300 Syn. |
| 1 | 150 | Whse. | 600 | 125 | 4150 Syn. |
| 1 | 125 | CW | 1200 | 125 | 2300 SC |
| 1 | 100 | Al. Ch. | 900 | 125/ 250 | 220/440 S.C. |
| 1 | 100 | CW | 1200 | 125 | 220/440 SC |
| 1 | 100 | El. Mach. | 1200 | 125 | 4150 Syn. |
| 3 | 94 | GE | 1200 | 60 | 440 SC |
| 2 | 40 | El.Mach. | 1750 | 125 | 440 SC |

**SYNCHRONOUS**

300 HP El. Mach. 720 RPM 2300 V T.E.F C. outdoor Service

200/100 HP Whse. 720/360 RPM. 4150 V.

**SLIP RING**

| | | | | | |
|---|---|---|---|---|---|
| 1 | 2500 | GE | MT | 6600 | 257 |
| 1 | 250 | Whse. | CW | 440 | 600 |
| 1 | 200 | Whse. | CW | 440 | 600 |
| 1 | 100 | GE | MT | 440 | 900 |
| 1 | 100 | GE | TM | 440 | 400 |
| 1 | 75 | GE | MT | 220 | 200 Vert |
| 1 | 75 | GE | MT | 440 | 1900 |
| 1 | 60 | GE | MT | 220 | 1750 |
| 1 | 60 | GE | MT | 440 | 900 |
| 1 | 50 | GE | MT | 220 | 1730 |
| 1 | 50 | GE | MT | 220 | 1200 |
| 1 | 50 | Whse. | CW | 220 | 900 |
| 1 | 50 | GE | MT | 220 | 1700 |
| 1 | 50 | GE | MT | 220 | 600 |
| 1 | 40 | GE | MT | 220 | 1200 |
| 1 | 40 | GE | MT | 2300 | 1200 |

FOR POWER
J. L. HEMPHILL & CO.
1604 53rd STREET, NORTH BERGEN, N. J.
PHONE NEW YORK—LONGACRE 5-3227
PHONE NEW JERSEY—UNION 3-2600

*Member of The National Industrial Service Association, Inc.*

## NORTHERN METAL CO. — MACHINERY at REDUCED PRICES

### BOILER

Water Tube. Babcock & Wilcox, 1945. 2 Drum, Bent Tube, Economisers, Internal Desuperheater. Superheaters: W.P. 400 P.S.I. Hydrostatic Press. 718 P.S.I. Heating Surfaces: 2441 sq. ft. Superheater 350 sq. ft. Economiser 1620 sq. ft. 3 Todd "Hex Press" Fuel Oil Burners. Diamond Soot Blowers. Auxiliaries available.

### BOILER

Mfr. Vancouver Iron Works, Vancouver, B. C. Type: Yarrow, 3 Drum, Bent Tube, Water Tube, Oil fired, 4 Burners, 55,000 lbs. steam per hr. Max. Heating Surface 6256 sq. ft. Working Press. 225 P.S.I. Test Press. 387 P.S.I. Built 2/7/43.

NUMEROUS OTHER ITEMS ARE AVAILABLE

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1—375 KVA—240/3/60 Westinghouse geared non condensing turbine.
2—37½ KVA—240 & 480/3/60 Cat. diesel sets.
1—50 KW—220 AC & 250 DC West. M.G. Set.
1—1000 HP—270 lb. Springfield boiler.

What do you need—what have you to sell—We have nationwide outlets to help you when buying or selling equipment.

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**B & W PULVERIZERS**

3—Type E-32 practically new Coal Pulverizers, complete with 75 H.P. motors, blowers and all equipment. Used approx. 2 years. Purchased new 1943.

DALTON SUPPLY CO.
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**ELECTRICAL CABLE**

- for every industrial and power application
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- Cut to length. Reasonably priced.

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OIL COOLED
AIR COOLED
PHASE CHANGES

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GArfield 5-0433

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REWOUND
REBUILT
RECONDITIONED

**BOILERS**
10 to 5000 H.P.
Diesel, Steam Turbine, Engine
**GENERATORS**
Heavy Power Equipment
Industrial — Chemical Process Equipment
UNUSED — RECONDITIONED
DEAN G. STRICKLER & ASSOCIATES
1346 Connecticut Avenue, N.W.
Washington 6, D. C. • DuPont 3286

# MOTORS - M.G. SETS - CONTROLS

## *NEW AND GUARANTEED REBUILT*

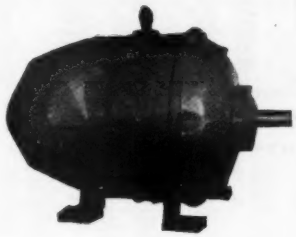
### NEW DIRECT CURRENT

230 volt-drip proof.

| Qu. | HP | RPM | Mfg. | Frame |
|---|---|---|---|---|
| 1 | 3 | 690/2660 | G.E. | 284 |
| 10 | 5 | 850/1700 | G.E. | CD-66 |
| 5 | 7½ | 575/1725 | G.E. | CD-77 |
| 1 | 10 | 575/2300 | L.A. | 4051 |

*Reconditioned and guaranteed*

| HP | RPM | Mfg. | Brgs. |
|---|---|---|---|
| 150 | 250/1000 | Rel | Sl. |
| 50 | 500/1500 | G.E. | Sl. |
| 50 | 1150 | Whse. | Sl. |
| 40 | 400/1200 | Rel (TE) | Ball |
| 35 | 400/1200 | Ideal | Sl. |
| 30 | 250/1000 | Whse. | S.Sl. |
| 30 | 500/1500 | Rel | Ball |
| 25 | 250/1000 | G.E. | Sl. |
| 25 | 400/1600 | Whse. | Sl. |
| 25 | 600/1350 | Rel | Ball |
| 25 | 690 | Rel | Ball |
| 20 | 300/1200 | Rel | Ball |
| 20 | 500/1500 | G.E. | Sl. |
| 15 | 250/1000 | G.E. | Sl. |
| 15 | 400/1600 | Whse. | Sl. |
| 15 | 400/1200 | G.E. | Sl. |
| 15 | 575/1000 | Rel | Ball |
| 15 | 575/1725 | L.A. | Ball |
| 15 | 1650/1650 | G.E. | Sl. |
| 15 | 700/1350 | Rel | Ball |
| 10 | 400/1600 | Whse | Sl. |
| 10 | 400/1600 | Rel | Ball |
| 10 | 600/1200 | Rel (TE) | Ball |
| 10 | 850 | Rel | Ball |
| 7½ | 200/1200 | Whse. (TE) | Ball |
| 7½ | 400/1600 | Rel | Sl. |
| 7½ | 400/1600 | Whse. | Ball |
| 7½ | 600/1800 | Rel (TE) | Ball |
| 7½ | 1150 | G.E. | Sl. |
| 3 | 850/1700 | Rel | Ball |



### M-G SETS

| KW | D.C. Volts | A.C. Volts | Mfg. |
|---|---|---|---|
| 500 | 250 | 2300 | G.E. |
| 400 | 125/250 | 2300 | Ideal |
| 300 | 250 | 2300 | Whse. |
| 200 | 250 | 2300 | Ridgeway |
| 100 | 250 | 2300 | G.E. |
| 75 | 250 | 220/440 | G.E. |
| 30 | 250 | 440 | Ideal |
| 20 | 250 | 220/440 | G.E. |
| 3VS | 250 | 220/440 | Rel. |

### CRADLE TYPE DYNAMOMETER

225 HP, Whse, 250 v. DC, 300/2000 RPM, complete with Toledo automatic printing type scale and all necessary control.

### SQUIRREL CAGE

| HP | RPM | Volts | Mfg. |
|---|---|---|---|
| 100 | 720 | 440 | Lincoln |
| 60 | 1800 | 440 | U.S. (vert.) |
| 50 | 1750 | 220/440 | Howell |
| 25 | 1750 | 440 | G.E. |
| 20 | 1750 | 440 | L.A. (TE) |

### SYNCHRONOUS

| HP | RPM | Volts | Mfg. | Type |
|---|---|---|---|---|
| 650 | 128 | 2300 | Whse. | Engine |
| 400 | 900 | 2300 | Whse. | 80% |
| 350 | 600 | 440 | Whse. | 100% |
| 300 | 720 | 550 | G.E. | 80% |
| 250 | 200 | 440 | G.E. | 100% |
| 200 | 720 | 440 | G.E. | 100% |
| 150 | 600 | 440 | G.E. | 100% |
| 100 | 1800 | 2300 | Whse. | 100% |
| 10 | 1800 | 220 | Whse. | 80% |

### SLIP RING

| HP | RPM | Volts | Mfg. |
|---|---|---|---|
| 400 | 900 | 2300 | G.E. (new) |
| 350 | 450 | 2300 | Whse. |
| 300 | 600 | 440 | G.E. |
| 200 | 450 | 2300 | Burke |
| 50 | 720 | 220 | Whse. |
| 50 | 900 | 220 | G.E. |
| 40 | 900 | 220 | G.E. |
| 7½ | 1800 | 220 | Rel. (New) |

### NEW MAGNETIC SLIP RING CONTROLS

3—ALLIS 250 HP, 440 volt (125 HP, 220 volt) Reversing, 7 accel. steps, main line air ckt. brkr., fully magnetic, open or enclosed.

***Buy from BOSWICK with confidence***

# BOSWICK ELECTRIC CO.

WAlbridge 1195

P.O. BOX 55 — AKRON 9, OHIO

## SCOTCH BOILER

300 H.P. International Brady type, A.S.M.E., 150# pressure.

Immediate Delivery.

**M. J. HUNT'S SONS**

1620 N. Delaware Avenue
Philadelphia 25, Pa.

## POWER PLANT EQUIPMENT

### *SPECIAL OFFERINGS*

**TURBO-GENERATORS**

2—4000 KW, 2300 V., 150# Cond.
1—3500 KW, 2300 V., 150# Cond.
1—3500 KW, 4000 V., 150# Cond.
1—3000 KW, 4600 V., 150# Cond.
1—2500 KW, 480 V., 150# Cond.
1—2500 KW, 550 V., 250# Cond.
1—2000 KW, 550 V., 175# Cond.
1—1500 KW, 2300 V., 200# Cond.
2—1250 KW, 2300 V., 225# Cond.
1—1000 KW, 2300 V., 250# Cond.
1—1000 KW, 4150 V., 200# N.C.
2—1000 KW, 480 V., 180# Cond.
1—1000 KW, 480 V., 150# Cond.
1— 750 KW, 550 V., 170# Extr.
1— 750 KW, 2300 V., 175# Extr.
1— 500 KW, 2300 V., 170# Extr.
1— 300 KW, 2300 V., 150# Cond.
1— 300 KW, 2300 V., 200# N.C.
1— 150 KW, 2400 V., 150# N.C.

**ENGINE GENERATORS**

1—600 KW, 2300 V., Unit.
1—500 KW, 230 V., D.C., Unit.
3—375 KVA, 550 V., Unit.
1—312 KVA, 440 V., Unit.

**REFRIGERATION UNITS**

3—300 ton motor or turbine driven

**BOILERS**

2—50,000#, 300#
1—30,000#, 425#
1—35,000#, 150#
2— 500 HP, 200#
3— 500 HP, 400#
1— 438 HP, 200#
2— 400 HP, 150#
6— 150 HP, 150# Sc. Mr.

*Write or wire for additional data and prints.*

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**MODERN 1000 KW Turbo-Generator**

***In Excellent Condition***

Non-Condensing, Steel case 80# back pressure .8 P.F., 3 phase, 60 cycle, 4150/2300 volts, alternating current, complete with accessories, switchboard, oil circuit breaker, and direct connected exciter. Only operated alternately for six years. Ideal for Chemical, Rubber, Petroleum, Textile, Pulp and Paper, and Sugar Refining Industries.

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## —TRANSFORMERS—

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**PIONEER TRANSFORMER REBUILDERS**

We rewind, repair and redesign all makes and sizes. *One Year Guarantee.*

**THE ELECTRIC SERVICE CO., INC.**

"AMERICA'S USED TRANSFORMER CLEARING HOUSE"

SINCE 1912 — CINCINNATI 27, OHIO

# MOTORS — M.G. SETS — TRANSFORMERS

## SQUIRREL CAGE MOTORS
### 3-Ph., 60-Cy.

| Qu | HP | Make | Type | Volts | RPM |
|---|---|---|---|---|---|
| 1 | 400 | G.E. | IK | 2200 | 514 |
| 1 | 400 | G.E. | RT-412 | 2300 | 435 |
| 2 | 300 | Whse. | CS-690 | 2300 | 1760 |
| 1 | 200 | Whse. | CS-873C | 2200 | 1160 |
| 1 | 200 | Al.Ch. | AR | 440/220 | 580 |
| 2 | 125 | Al.Ch. | AR | 2200 | 1750 |
| 1 | 125 | Whse. | CS-781C | 440/220 | 1760 |
| 1 | 125 | C.W. | 126-Q | 440/220 | 435 |
| 2 | 100 | Whse. | CS-683C | 440/220 | 1750 |
| 1 | 100 | G.E. | IK | 440/220 | 1800 |
| 1 | 100 | Al.Ch. | AR | 2200 | 1160 |
| 1 | 100 | Al.Ch. | AR | 550 | 690 |
| 1 | 100 | F.M. | H241B | 440/220 | 435 |
| 1 | 100 | Whse. | CS-938 | 2200 | 695 |
| 1 | 78 | G.E. | I-K15 | 440/220 | 570 |
| 1 | 75 | Al.Ch. | AR | 2200 | 1765 |
| 1 | 75 | Al.Ch. | AR | 2200 | 1750 |
| 1 | 75 | Al.Ch. | AR | 2200 | 690 |
| 1 | 50 | G.E. | RT | 440/220 | 1160 |

## SYNCHRONOUS MOTORS
### 3-Ph., 60-Cy.

| Qu | HP | Make | PF | Volts | RPM |
|---|---|---|---|---|---|
| 1 | 2000 | Whse. | 80 | 4800/2400 | 720 |
| 1 | 700 | G.E. | 80 | 2300 | 720 |
| 1 | 600 | Whse. | 80 | 2400 | 720 |
| 1 | 400 | Whse. | 80 | 440 | 650 |
| 1 | 300 | Whse. | 80 | 440 | 514 |
| 1 | 150 | G.E. | 100 | 2200 | 900 |
| 1 | 150 | G.E. | 100 | 550/2200 | 600 |
| 1 | 150 | G.E. | 80 | 550/2200 | 450 |
| 3 | 125 | El.Mchy. | 100 | 4800/2400 | 900 |
| 1 | 125 | G.E. | 80 | 2200 | 900 |
| 2 | 100 | Whse. | 80 | 440/220 | 1800 |
| 1 | 100 | Whse. | 100 | 2200 | 1200 |
| 1 | 100 | Ideal | 80 | 220/440 | 900 |
| 2 | 100 | G.E. | 80 | 220/440 | 600 |

## SLIP RING MOTORS—CONSTANT DUTY—3-Ph., 60-Cy.

| Qu | HP | Make | Type | Volts | RPM |
|---|---|---|---|---|---|
| 1** | 3000 | G.E. | MT | 2200 | 356 |
| 1** | 1200 | C.W. | SR | 2200 | 237 |
| 2** | 1000 | Al.Ch. | ANY | 2200 | 235 |

| Qu | HP | Make | Type | Volts | RPM |
|---|---|---|---|---|---|
| 1** | 600 | G.E. | MT-20 | 2200 | 360 |
| 1 | 500 | Whse. | C.W. | 4800/2300 | 514 |
| 1 | 500 | Al.Ch. | ANY | 4000/2300 | 514 |
| 1** | 400 | Al.Ch. | ANY | 2200 | 514 |
| 2 | 500 | G.E. | I-16-M | 2300 | 450 |
| 2 | 400 | G.E. | MT-412 | 2200 | 450 |
| 1 | 300 | G.E. | I-15-M | 2200 | 1200 |
| 1 | 300 | Al.Ch. | ANY | 2200 | 514 |
| 1 | 250 | G.E. | MT-414 | 2200 | 300 |
| 1 | 200 | G.E. | I-16-M | 2200 | 585 |
| 1 | 150 | G.E. | I-13-M | 2200 | 1750 |
| 1*** | 125 | Whse. | CW-870 | 2200 | 870 |
| 1 | 100 | F.M. | H200C | 440/220 | 900 |
| 1 | 75 | G.E. | IM | 440/220 | 695 |
| 1 | 75 | Whse. | CW-7540 | 440/220 | 690 |

**Mill type pedestal bearing. ***3 bearing.

## MOTOR GENERATOR SETS

| Qu | KW | | Make | RPM | Volts DC | Volts AC |
|---|---|---|---|---|---|---|
| 1 | 2400 | 3U | Al.Ch. | 720 | 525 | 4800/2400 |
| 1 | 1500 | | Whse. | 514 | 250 | 4600/2300 |
| 2 | 1000 | | G.E. | 514 | 575 | 4000/2300 |
| 1 | 500 | 3U | Whse. | 1200 | 120/240 | 2300/440 |
| 2 | 500 | | C.W. | 720 | 575 | 4000/2300 |
| 1 | 500 | | C.W. | 720 | 250/275 | 4000/2300 |
| 1 | 500 | | C.W. | 720 | 250/275 | 2300/440 |
| 1 | 200 | | Ridgway | 900 | 250 | 2300 |
| 1 | 155 | | G.E. | 720 | 250 | 2300/440 |
| 1 | 150 | | G.E. | 1200 | 600 | 2300/440 |
| 1 | 100 | | Ridgway | 1200 | 275 | 4000/2300 |
| 1 | 85 | | C.W. | 1200 | 250 | 2300/440 |
| 1 | 75 | | Star | 1200 | 230 | 440/220 |
| 1 | 75 | | Al.Ch. | 900 | 250 | 2300 |
| 1 | 50 | | Burke | 1800 | 240 | 440/220 |
| 1 | 30 | | Reliance | 1800 | 250 | 440/220 |
| 1 | 25 | | Whse. | 1200 | 120/240 | 440/220 |
| 1 | 20 | | Reliance | 1800 | 250 | 440/220 |

(3U—3-unit set.)

## TRANSFORMERS (Power)

| Qu | KVA | Make | Type | Phase | Voltage |
|---|---|---|---|---|---|
| 1 | 7500 | G.E. | H | 3 | 33000/29700-13800/12600 |
| 3 | 1500‡ | Gregory | (X) | 3 | 4160-480 |
| 3 | 250 | Packard | OISC | 1 | 13200-2200 |
| 3 | 130 | G.E. | H | 1 | 19000/9500-550/2200 |
| 3 | 100 | Whse. | SH | 1 | 12075/10955-230/460 |
| 3 | | G.E. | HT | 1 | 33000/2400 |
| 3 | 50 | Al.Ch. | OISC | 1 | 22000-220 |
| 3 | 50 | Wagner | HE | 1 | 13200/11880-575/287 |
| 3 | 50 | Penna | OISC | 1 | 2400/4160-Y-120/240 |

(X) New, selfcontained, indoor type, air cooled.

## DIRECT CURRENT MOTORS

| Qu | HP | Make | Type | RPM |
|---|---|---|---|---|
| 1*** | 3000 | Whse. | Encl.(Rev.) | 600 |
| 1*** | 2400 | Whse. | Encl.(Rev.) | 600 |
| 4*** | 1500 | Whse. | Encl.(Rev.) | 600 |
| 4*** | 1200 | Whse. | Encl.(Rev.) | 600 |
| 4*** | 800 | Whse. | Encl.(Rev.) | 600 |
| 1 | 350 | G.E. | CD-169 | 1150 |
| 1 | 325 | Whse. | QM-460 | 450/900 |
| 1 | 200/250 | El.Dy. | 422 | 400/1200 |
| 1*** | 200 | G.E. | MPC | 500/1200 |
| 1 | 200 | Whse. | Mill | 300/1200 |
| 1 | 300 | Whse. | | 240/300 |
| 1 | 180 | G.E. | MPC | 400 |
| 2* | 180 | C.W. | 83-H | 890 |
| 1*** | 125 | Whse. | SK-190 | 600 |
| 1 | 100/125 | Rel. | 1995-F | 300/1200 |
| 2 | 100 | Rel. | 1050-T | 400/1200 |
| 1 | 90/180 | G.E. | MPC | 625/1125 |
| 1* | 50/75 | Rel. | 1995-F | 300/1200 |
| 1 | 35 | G.E. | RF-14 | 500/1400 |
| 1 | 35 | G.E. | CD-125 | 400/1200 |
| 1 | 35 | G.E. | CD-147 | 300/1200 |
| 1 | 35 | Rel. | 35P | 280/1000 |
| 1 | 32½ | Whse. | SK-150 | 400/1200 |
| 1* | 30/75 | Whse. | SK-151L | 400/1200 |
| 1 | 30 | Al.Ch. | E-145 | 400/1200 |
| 1 | 30 | G.E. | CDM-105 | 675/1750 |
| 2 | 27½ | El.Dy. | 158 | 450/1350 |
| 1 | 25 | G.E. | RF-13 | 400/1600 |
| 1 | 25 | G.E. | CD-123 | 400/1200 |
| 1 | 25 | Whse. | SK-140 | 400/1200 |
| 1 | 25 | Whse. | SK-111L | 280/1000 |
| 2 | 20 | Al.Ch. | E-130 | 400/1200 |
| 3 | 20 | G.E. | CD-123 | 300/1200 |

All above 230-VDC except where marked ***
*** Pedestal bearing mill design 525/900-VDC.
(Rev.) Designed for mill reversing service
* T.E.F.C.

# T. B. MAC CABE COMPANY

4314 CLARISSA STREET — Phone DAvenport 4-8300 — PHILADELPHIA 40, PENNA.

## MOTOR GENERATOR SPECIAL — *LIKE NEW*

2—500 KW WESTINGHOUSE D.C. GENERATORS, 250 volt, D.C. 2000 amps. 900 rpm Serial No. 8130443-44, Direct Connected to 720 HP Westinghouse Synchronous Motors, 3 phase, 60 cycle, 13,200 volt 900 rpm Serials 8130447-48. UNITS CAN BE SEEN RUNNING ON PRESENT FOUNDATION IN PHILADELPHIA TILL RELEASE AUGUST 5th, 1951.

***OFFERED FOR SALE NOW***

AS IS—WHERE IS SUBJECT TO INSPECTION AND PRIOR SALE.

***Philadelphia's Largest Machinery Dealers and Exporters***

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## THE O'BRIEN MACHINERY CO.

1547 N. Delaware Avenue, Philadelphia 25, Pennsylvania

## REDUCING-DESUPERHEATING VALVES, MOTOR-OPERATED (Schutte & Koerting)

| Quantity | Size | Capacity lb/hr | Pressure psig | °F Temp. | Quantity | Size | Capacity lb/hr | Pressure psig | °F Temp. |
|---|---|---|---|---|---|---|---|---|---|
| 3* | 3" x 5" | 30,000 | 1340 | 935 | 3* | 4" x 8" | 25,000 | 500 | 850 |
| 1 | 3" x 6" | 50,000 | 1350 | 850 | 1 | 6" x 12" | 50,000 | 360 | 470 |

*One each in original shipping crates. All others listed were used not over 500 hours each.

FS1129 POWER, 520 N. Michigan Ave., Chicago 11, Ill.

## FOR SALE

1—Venturi Meter, 3"x1"
1—3" Copes Regulator, 150# pressure
2—3" Copes Regulators 280#, complete with brass valves and ells
1—6" Mason-Neilan Reducing Valve, 125#—½#—10#
2—4" Consolidated Safety Valves 150#, 2½, 580# release
4—3½" Consolidated Safety Valves, 200#, 18, 400# release
1—Flanged inlet similar to #1411
2—4" Crosby Safety Valves 125# HRT04—Mass. Standard Release 9250#
1—10 H.P. Ingersoll-Rand Compressor 200# pressure with motor
2—3 H.P. Motors 550 volt
3—Ratio motors ⅛ & ½ H.P., 220 volts, 3-phase
Valves, New & Used ½" to 6" to 250#
Pipe Fittings, ½" & 1½"
Flanged Tees & Ells, 4" & 8"
Air Tanks, all sizes up to 42" x 10'

**BOILER EQUIPMENT TRUST**
AMHERST, MASSACHUSETTS

## FOR SALE

2—Late 2000 KW GE Turbo Generators
2—4000 HP Sync. Motors—257 RPM
1—Rotary Compressor 60000 CF/H 4#
1—IR Compressor 20,000 CF/H @ 100#
1—Deaerating F.W. Heater 10,000#/hr.

**UTILITY EQUIPMENT & CONSTRUCTION CO.**
316 So. LaSalle Street, Chicago, Ill.

## PUMPS—COMPRESSORS—BLOWERS

1—2000 GPM 350' Pump with 240 HP Turb.
1—730 GPM 231' Pump with 75 HP 3 ph. motor
2—675 GPM 428' Pumps with 125 HP Turb.
1—230 GPM 558' Pump with 50 HP 3 ph. motor
1—200 GPM 556' Pump with 50 HP Turb.
1—100 GPM 220' Al.-Ch. Cent. Pump
4—2000-5000 GPM 32'-60', 10" & 12" Pumps
1—1000 GPM 280' all-bronze Cent. Pump
4—Kinney unused 6" Rotary Pumps
3—Blackmer 6" Rotary Pumps 500 GPM
3—750 & 1000 GPM Knowles Steam Pumps
1—6" x 10" & 1—7" x 10" Triplex Pumps
1—3" x 6" Gallaud Hydraulic Triplex Pump
1—6" x 10" Gardner duplex Pump 300 GPM
1—12" x 14" Duplex Air Compressor 550 CFM
1—12"x10" I-R Air Compressor 355 CFM
2—12"x10" Worth. Comp. 375 CFM, Vac. & Press.
1—4-stage Norwalk Compressor 28 CFM 5000 PSI
1—Sturt. 60 H.P. Tur.-Blower 7000 CFM 20 oz.
1—GE 2-stage Turbo Blower 3000 CFM 16 PSI
1—Spencer 30 H.P. Tur. Blower 4000 CFM 10 oz.
1—60 H.P. DC 230 v. 1150 RPM comp. C-W Motor
1—50 H.P. DC 230 v. 1750 RPM ball.-bear Motor
10—Nash Vacuum Pumps and Vac.-Heating Units
250—Rebuilt Motors 1—200 H.P.
72—Exhaust Blowers, Fans, Unit Heaters

HUNDREDS OF OTHER ITEMS—ALL SIZES—ALL MAKES

## SUPERIOR EQUIPMENT CO.

136 GRAND ST., N.Y.C. 13. CA 6-6983

600-500-300-100-15-10 HP BOILERS
150,000 & 100,000 Gal. Tanks & Towers
4½ Ton 68½' Span O.E.T. Cranes—Cab—AC
30,000 Gal. (3) Oil Storage Tanks—Steel
1 to 100 HP NEW Motors; also 600 HP
625 KVA Turbo 200# Condensing-Surface
100-200-250-300-675-750 KVA Eng—Gens.

H. & P., 6719 Etzel, St. Louis 14, Mo.

## EQUIPMENT—IMMEDIATE DELIVERY

2—400 HP—1—316 HP—3 Drum Boilers rated two years—Economic Boilers 150 to 250 HP—50 HP Vertical Gas Boilers
750 KVA Corliss Engine—1—581 KW D.C. New Gas Sets
500—1000—1500 KW Rotary Converters—Mercury Arc Rectifiers
800—1500—3000 Ft. Air Compressors
10,000—80,000—1,650,000 Gal. Tanks—Steel—Oil Tank Cars—Steel Stacks—Pipe

H. A. Woodworth Eng. Co., 611 Olive St., St. Louis

## TURBO GENERATORS

25,000 KVA G.E. condensing, 200 lbs., 530° FTT, 13,200 volts.

15,625 KVA G.E. condensing, 250 lbs., 500° FTT, 13,200 volts.

12,500 KVA Allis condensing, 225 lbs., 550° FTT, 13,200 volts.

6,250 KVA Allis condensing, 200 lbs., 500° FTT, 2300/4000 volts.

5,000 G.E. non-condensing extraction, 600 lbs., 750° FTT, 125/150 lbs. extraction, 0-50 lbs. exhaust, 13,800/4000 volts.

5,000 KVA Westg. condensing double extraction, 400 lbs., 600° FTT, 125 lbs. and 20 lbs. extraction, 480 volts.

3,750 KVA G.E. condensing, 150-250 lbs., 500° FTT, 2300/600 volts.

2,500 KVA G.E. condensing extraction, 200 lbs., 550° FTT, 20 lbs. extraction, 480 volts.

1,875 KVA G.E. condensing, 150-250 lbs., 650° FTT, 2300 volts.

1,250 KVA G.E. condensing, 200-400 lbs., 650° FTT, 2300/4150 volts.

1,250 KVA G.E. condensing extraction, 175-400 lbs., 700° FTT, 0-10 lbs. extraction, 2300 volts.

1,250 KVA Westg. condensing extraction, 150-250 lbs., 600° FTT, 5-25 lbs. extraction, 480 volts.

1,250 KVA Ridgway non-condensing, 150 lbs., 450° FTT, 0-15 lbs. exhaust, 240/480 volts.

625 KVA Westg. non-condensing, 150-200 lbs. 600° FTT, 5-25 lbs. exhaust, 480 volts.

375 KVA Ridgway non-condensing, 150 lbs., 450° FTT, 0-15 lbs. exhaust, 240/480 volts.

## UNIFLOW UNITS

750 KVA Ames-Allis Chalmers vertical, 150 lbs. steam, 5 lbs. exhaust, 2400/4160 volts.

625 KVA Skinner-G.E., 150 lbs. steam, 5 lbs. exhaust, 240 volts.

375 KVA (2) Elliott, 150 lbs. steam, 2 lbs. exhaust, 2300 volts.

312 KVA Skinner-G.E., 150 lbs. steam, 3 lbs. exhaust, 480 volts.

250 KVA (2) Skinner-G.E., 150 lbs. steam, 5 lbs. exhaust, 2300 volts.

## CORLISS UNITS

500 KVA Chase, 150 lbs. steam, 10 lbs. exhaust, 480 volts.

312 KVA Allis Chalmers, 150 lbs. steam, 3 lbs. exhaust, 2300 volts.

## BOILERS

1,000 HP Springfield, 120,000 lbs. per Hr., 300 lbs. steam, 600° FTT, stoker fired.

825 HP C.E., 275 lbs. steam, 525° FTT, pulverized fuel.

720 HP (2) C.E. 60,000 lbs. per Hr., 450 lbs. steam, 600° FTT, stoker fired.

540 HP Keeler, 250 lbs. steam, pulverized fuel or oil fired.

350 HP (2) Wickes, 350 lbs. steam, 600° FTT, oil and gas fired.

300 HP (2) Keeler, 10,000 lbs. per Hr., 250 lbs. steam, 500° FTT, stoker fired.

150 HP (3) Bros HRT, 125 lbs. steam, stoker fired.

## DIESEL GENERATORS

1,675 KVA Fairbanks - Morse, 2400/600/480 volts, 300 RPM.

1,388 KVA McIntosh-Seymour, 2300 volts, 300 RPM.

900 KVA Fairbanks-Morse, 2400 volts, 257 RPM.

782 KVA Worthington, 480 volts, 327 RPM

546 KVA Worthington, 480 volts, 327 RPM.

312 KVA Superior, 480 volts, 360 RPM.

### SPECIAL

1675 KVA Fairbanks-Morse generator, 3 phase 60 cycle 2400/600/480 volts, 300 RPM direct connected to 1750 HP F-M diesel engine, 2 cycle, 10 cylinder, Model 33E16, 300 RPM.
Complete with direct connected exciter, switchgear, and all auxiliaries as in operation. New 1942, excellent condition. Engine can be adapted for dual fuel operation.

## RECTIFIER

1,000 KW G.E. Mercury Arc Rectifier, 600 volts DC, 60 cycle, 13,200 volts AC.

## HIGH FREQUENCY GENERATORS

2,860 KVA (3) New G.E. AC generators, Type ATB, 3 phase, 120/240 cycles, 4150 volts, 4800 RPM

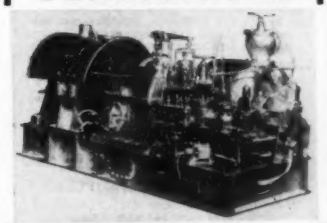
## FREQUENCY CHANGER

3,750 KVA G.E. generator, 3 phase, 60 cycle, 2300/4000 volts, direct connected to 4200 HP G.E. synchronous motor, 3 phase, 25 cycle, 440/22,000 volts, 300 RPM.

**INTERNATIONAL POWER MACHINERY COMPANY**

**1609 UNION COMMERCE BLDG. Telephone: MAin 1-9514 CLEVELAND 14, OHIO**

*FOR SALE*
**TURBO GENERATORS**



**GE 200 KW 120V**
*ALSO AVAILABLE:*
**132 KW, 200 KW, 500 KW, 3/60/450 AC**

●

**1500 HP DC MOTORS WESTINGHOUSE**

●

**1200 KW DC GENERATORS —ALLIS CHALMERS**

●

**DIESEL DIVISION**
**NATIONAL METAL & STEEL CORP.**
**Dept. P, Terminal Island**
**(Los Angeles Harbor), Calif.**
**Phone Los Angeles: Nevada 6-2517**

# DIESEL POWER PLANTS

**50 KW TO 1250 KW**

***Remanufactured—Guaranteed! Immediate Delivery!***

GM 8-268A Propulsion Engine with reduction gear
GM 3-268A 100 KW AC or DC with Switchboard
GM 8-268A 200 KW AC with Switchboard
GM 12-567A 900 H. P. Marine Propulsion Complete with accessories
GM 16-278A 1600 H. P. Marine Propulsion
Superior GDB-8 150 H. P. 100 KW D.C. 3 wire with or without Generator

*Also Diesel Parts*

**HERCULES ELECTRIC MACHINERY and EQUIPMENT CO.**
**1442 E. Washington Blvd. Los Angeles 21, Calif.**
**Phone: Richmond 5269**
**Cable — "HEMCOY"**

# COMPLETE POWER PLANTS

**STEAM — ELECTRIC — HYDRO — DIESEL**

***"Export Orders Carefully Executed"***

BOILER UNITS

1—100,000# cap., 350# Steam Gen. 85% efficiency.
2—60,000# capacity 450# Boiler with superheat
1—50,000# Edgemoor 225# Superheat.
2—32,000# ea. cap. 450# Generator, S/heat airheater
2—1000 HP Stirling type Boilers 250#—super
2—850 HP B&W Stirling type Boilers
2—516 HP; 2—315 Heines 165# several 200 HP
3—300 HP B&W Sectional Headers 100#
2—300 HP Heine Cross-Drum 200#
1—Complete 800 HP Boiler Plant, 240# incl. bldg.
1—500 HP B&W Steel Sectional Header Boiler
2—400 HP B&W Steel Sectional Header Boilers

TURBO UNITS

2—10,000 KW Turbo-Generator—Cond.
1— 7,500 KW Turbo-Generator—Cond. 600#
1— 5,000 KVA Turbo-Generator 450# with condens.
2— 5,000 KW Turbo-Generator—Cond.
2— 3,000 KW Turbo-Gen. and Cond., one aut. extrac.
2— 2,500 KW Turbo-Generators and Condensers
3— 2,000 KW Turbos & Condensor
2— 1,500 KW Turbos & Condensor
2— 1,250 KW Turbos & Condensor
2— 1,000 KW, also 750 & 500 KW Units, Condens.
Non-Cond.:—300—500—750—1000—1500—2000

Also smaller Boilers & Fire Tube Boilers Frequency Changers—Motor-Generators &Diesel-Generators

**TRANSFORMERS!** Quick Delivery, Various Sizes
Rebuilt like NEW—Guaranteed.

*Send us your* INQUIRIES *for* ALL POWER MACHINERY

**CHARLES B. REARICK 30 CHURCH ST. NEW YORK 7, N. Y.**

# MOTORS • GENERATORS • TRANSFORMERS

### 7x7 AIR COMPRESSOR

Ingersoll Rand 7x7 Class ERI—100#—with or without drive.

1—400 KW Westinghouse 580 V. DC 750 RPM 800 Amps. Motor—580 HP. Synchronous 3 Ph. 25 cycle 440 V. 750 RPM.

### ANODIZING M.G. SET

33 KW Gen. Elect. Type BR. Form C 60 V. DC. Direct connected to 50 HP. 3/60/440/1800 Gen. Elect. Motor.

### 600 HP GEAR REDUCER

1—600 HP Farrel-Birmingham Herringbone Gear Unit. Type SL. Size 30/16 Speed 730 RPM to 115 RPM.

### 400 HP GEAR REDUCER

1—400 HP Nuttall (Westinghouse) Type LMR-25 Single Helical Heavy Duty Reducer—6-1 Ratio at 900 RPM with High Speed Shaft Extension for Brake.

### 400 HP SYNCH. MOTOR

1—400 HP Westinghouse Synchronous Motor. 3/60/2300/900 RPM. Unity P.F. with direct connected exciter—Late Type.

### MOTORS

60-50-25 Cycle in Stock—All Sizes. Slipring—Squirrel Cage—Synchronous. All types of Control Equipment.

100 HP Westinghouse Slipring 3 Bearing 3/60/220/440/435 RPM.

100 HP Gen. Electric Type I form K 3/60/2300/600 RPM.

100 HP Gen. Electric Type KT 356 3/60/2200/900 RPM.

125 HP Gen. Electric Type I form K 3/60/440/720 RPM.

125 HP Gen. Electric Type KT 3/60/2300/1200 RPM.

150 HP Gen. Electric Type KT 3/60/440/500 RPM.

150 HP Gen. Electric Type I form K 3/60/2300/720 RPM.

150 HP Gen. Electric Type I form K 3/60/2300/900 RPM.

200 HP Gen. Electric Slipring Type I form M 3/60/440/600 RPM.

200 HP Gen. Electric Type KT 3/60/440/600 RPM.

250 HP Gen. Electric Type KT 3/60/440/720 RPM.

### 350 KW GENERATORS

2—350 KW General Electric Generators Type MPC, 250 Volt DC, 720 RPM Single Bearing Machines.

### MOTORS

250 HP Gen. Electric Synchronous Type ATI 3/25 cycle/2200/500 RPM.

350 HP Westinghouse Slipring Type CW, 3/25 cycle/2200/500 RPM.

400 HP Westinghouse, Synchronous 3/60/2300/900 RPM.

### DC CIRCUIT BREAKERS

1—1000 AMP. Condit. 2 Pole

1—1600 AMP. Condit. 2 Pole

1—1600 AMP. Westinghouse 2 Pole

1—3000 AMP. Westinghouse 2 Pole

### 125 VOLT DC MOTORS

1—100 HP Crocker Wheeler 125 Volt DC 850 RPM Ball Bearing

1—150 HP Crocker Wheeler 125 Volt DC 850 RPM Ball Bearing.

Will make 1200 RPM 125 Volt Generators.

### REBUILT TRANSFORMERS

3—100 KVA G.E. 1 ph., 60 cy., 2400/4160 pri., 120/240 sec.

3—1667 KVA Wagner 1 ph., 25 cy., 23,000 pri., 575 sec.

## ERIE ELECTRIC CO., INC.

124 CHURCH ST. BUFFALO, N. Y.
CL. 4758

## GEARMOTOR HEADQUARTERS

***We stock REBUILT gearmotors up to 60 HP***

We stock NEW gearmotors and can ship from stock up to six weeks on most popular sizes.

3 phase 60 cycle 220/440 volt NEW GEARMOTORS in stock

| | | | |
|---|---|---|---|
| 1 | HP 280 rpm with C-H brake | 5 | HP 280 rpm |
| 1 | HP 473 rpm | 5 | HP 520 rpm |
| 1 | HP 520 rpm | 7½ | HP 280 rpm |
| 2 | HP 45 rpm | 7½ | HP 520 rpm |
| 2 | HP 230 rpm | 10 | HP 190 rpm |
| 3 | HP 20 rpm T.E.F.C. | 15 | HP 350 rpm |
| 3 | HP 45 rpm | | |
| 3 | HP 84 rpm | | Quantities in most ratings |
| 3 | HP 420 rpm | | Also some 550 volt ratings |

Electric Motors, Generators, Transformers, Grids, Gearmotors, Speed Reducers, Compensators, Drum Switches

SANDMAN Electric

## SANDMAN ELECTRIC CO., INC.

165 OLIVER ST., BOSTON 10, MASS.
SALES & SERVICE Tel. HUbbard 2-6750

*New England's Leading Electric Motor Dealer*

John H. Benson Roy L. Wilimzig

## MOTORS!!

5—250 HP, 1170 RPM, Allis-Chalmers, Splash-Proof, Frame 630—DSWW, 3/60/2300. Will Reconnect 220 or 440

1—150 HP, 277 RPM, GE, Synchronous Motor, 3/60/2300, complete with Exciter, Starting Equipment and Magnetic Clutch

1—125 HP, 1800 RPM, F-M, Slipring, Frame R161D 3/60/2300, Control available

1—1000 KVA—AC Generator Westinghouse, 3/60/2300 V. 720 RPM

1—1000 KVA Synchronous Condenser, 3/60/2300/4000 600 RPM

*1000 other motors in stock!*

*Phone, Write or Wire!*

### BENSON-WILIMZIG, INC.

formerly C & S Machinery Co.
1708 N. 8th St. St. Louis, Mo.
GA-4290

## FOR IMMEDIATE DELIVERY

SUB-PRIOR SALE
**1250 K.W. G. E. TURBOGENERATOR**
2300 V. 3 Ph. 60 Cy. WITH EXCITER & SPARES
200 PSIG—100° SUPERHEAT—3" BACK PRESSURE
COMPLETE WITH CONDENSER, CIRCULATING,
CONDENSATE PUMPS & AIR EJECTOR.

### SPECIALTIES SERVICE & ENGINEERING CO., INC.

SEABOARD TRUST BUILDING HOBOKEN, NEW JERSEY
Tel. N. Y. RE. 2-9362 — N. J. HOB. 3-4426

## FOR SALE

### M-G SET

HERTNER ELEC. GENERATOR. 62.5 KW, 1150 RPM, 50 Volt, D.C. 1000 Amps.

HERTNER 100 HP Motor 1150 RPM. 220 Volt 3 Phase 60 Cycle.

TEN-STATION SWITCHBOARD. Complete with Starter & Disconnect Switch.

### PUNCH PRESS SALES CO.

1521 St. Jean, Detroit 14, Mich.
Phone: VA. 2-1930

# PARTIAL LISTINGS OF EQUIPMENT AVAILABLE FOR YOU

## MOTOR GENERATOR SETS

3 Ph. 60 cycle

| KW | DC Output | AC Input | Speed | Make |
|---|---|---|---|---|
| ¾ | 110 | 220 | 1800 | Ideal |
| ½ | 120 | 110/220 | 1800 | Cont. |
| 1 | 115 | 220/440 | 1800 | GE-Delco |
| 1.15 | 115 | 220 | 1800 | Watts |
| 5 | 230 | 440 | 1200 | Whse. |
| 7½ | 230 | 220/440 | 1800 | Whse.-Howell |
| 7½ | 125 | 220 | 1200 | Whse.-G.E. |
| 10 | 250 | 220/440 | 1800 | Whse. |
| 12½ | 230 | 220 | 1800 | Whse. |
| 20 | 125 | 220 | 900 | G.E.-A.-C. |
| 22 | 125 | 115 | 900 | A.-C. |
| 47½ | 125 | 2300 | 1200 | A.-C. |
| 50 | 125 | 440 | 1800 | C-W |
| 50 | 250 | 220 | 1200 | A-C-Whse. |
| 75 | 125 | 440 | 1200 | G.E. |
| 100 | 250 | 440 | 1200 | G.E. |
| 300 | 250 | 440 | 900 | G.E.-E-M |
| 400 | 250 | 220/440 | 1200 | G.E.-Whse. |
| 750 | 550 | 13200 | 900 | Whse |

## ROTARY CONVERTERS

| KW | DC Volts | AC Volts | RPM | Make |
|---|---|---|---|---|
| 1700 | 250 | * | 514 | G.E. |
| 300 | 600 | 33000 | 1200 | Whse. |
| 150 | 250 | * | 1200 | Whse. |

* Will wind for any voltage.

## SQUIRREL CAGE MOTORS

Open—3 Phase—60 Cycle

| HP | RPM | VOLTS | MFR. |
|---|---|---|---|
| ¼* | 1800 | 220 | Electro |
| ¼ | 1200 | 220 | G.E. |
| ½ | 3600 | 220 | Whse. |
| ½* | 1800 | 550 | Master |
| ½ | 1800 | 440 | Whse. |
| ⅓ | 1200 | 440 | Whse. |
| ½* | 900 | 550 | G.E. |
| ¾ | 1800 | 440 | G.E. |
| ¾ | 1200 | 220/440 | Delco |
| 1 | 3600 | 550 | G.E. |
| 1* | 1800 | 220/440 | G.E. |
| 1 | 1200 | 440 | Delco |
| 1 | 600 | 220 | C-W |
| 1½ | 3600 | 220/440 | Delco |
| 1½* | 3600 | 220/440 | Century |
| 1½* | 1800 | 220/440 | G.E. |
| 1½ | 1800 | 220 | Whse. |
| 1½ | 1200 | 220/440 | Delco |
| 1½* | 1200 | 220/440 | G.E. |
| 1½ | 900 | 440 | Delco |
| 2 | 3600 | 220/440 | Delco |
| 2* | 1800 | 220/440 | Wagner |
| 2 | 1800 | 220 | G.E. |
| 2 | 1200 | 220 | C-W |
| 2* | 1200 | 220/440 | G.E. |
| 2½ | 340 | 220 | Ilg |
| 3 | 3600 | 440 | Delco |
| 3 | 1800 | 440 | Whse. |

* New

## SPECIAL

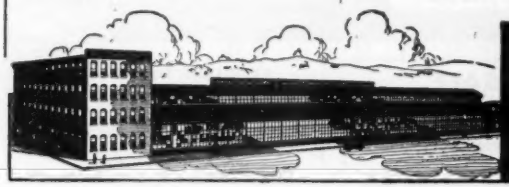
3—G.E. Rectifiers, 500 amp., 6 volt, DC output 440 Volt, 3 Phase, 60 Cycle Input, New Copper Oxide Stacks.

## SLIP RING MOTORS

3 Phase, 60 Cycles

| HP | RPM | VOLTS | MFR. |
|---|---|---|---|
| ¾ | 1800 | 220 | Watson |
| ¾ | 1800 | 220 | Whse. |
| ¾ | 1200 | 220 | Fidelity |
| 1 | 1200 | 220 | G.E. |
| 1 | 600 | 220 | Kline |
| 1½ | 1200 | 220 | Whse. |
| 2 | 1800 | 220 | Wesche |
| 2 | 600 | 440 | Kimble |
| 3 | 1800 | 220/440 | Whse. |
| 5* | 1200 | 220/440 | Whse. |
| 5 | 1200 | 220 | Delco |
| 5 | 900 | 220 | G.E. |
| 7½ | 1200 | 440 | AL-Ch. |
| 7½ | 900 | 440 | G.E. |
| 10 | 1800 | 220 | L-A |
| 10 | 1200 | 220 | Howell |
| 15 | 1200 | 220 | Howell |
| 15 | 900 | 440 | G.E. |
| 15 | 720 | 550 | G.E. |
| 20 | 1800 | 440 | G.E. |
| 20 | 1200 | 440 | G.E. |
| 20 | 900 | 440 | AL-Ch. |
| 20 | 720 | 440 | G.E. |
| 20 | 600 | 440 | Whse. |
| 25 | 1200 | 220 | Wesche |
| 25 | 900 | 220 | G.E. |
| 25 | 720 | 220 | Whse. |
| 30 | 1800 | 2300 | Whse. |
| 30 | 1800 | 220 | G.E. |
| 30 | 900 | 440 | Whse. |
| 30 | 720 | 220 | G.E. |
| 30 | 600 | 220 | F-M |

* New



**GLOW ELECTRIC CO.**
927 HARRIET ST. CINCINNATI 3, OHIO
PHONE MAIN 3024

---

FOR SALE

## TRANSFORMERS

*All 1 phase, 60 cycle, air cooled*

| No. | KVA | High Voltage | Low Voltage | Mfr. |
|---|---|---|---|---|
| 1 | 2500 | 14625/12440 | 3160/2640 | G.E. |
| 2 | 2000 | 14100/7510 | 3100/1403 | Whse |
| 5 | 2000 | 14000/11990 | 2940/2785 | Whse |
| 6 | 1000 | 14000/7510 | 2945/2795 | G.E. |
| 3 | 1000 | 14000/7510 | 2945/2811 | Whse |
| 6 | 50 | 2750/1375 | 220/110 | Whse |
| 6 | 25 | 2750/1375 | 220/110 | Whse |

## INDUCTION REGULATORS

38—60 KVA Induction regulators, 1 phase, 60 cycle, 10% regulation, primary voltage 3000, secondary amperage 200. Westinghouse type C.

## CURRENT LIMITING REACTORS

3—115 KVA, 300 amps, 60 cycles, 13200 V
18—91.5 KVA, 300 amps, 60 cycles, 13200 V

## OIL CIRCUIT BREAKERS

18—15000 V, 600 amps 8—3800 V, 1200 amps
28— 7500 V, 300 amps 34—3000 V, 300 amps
2— 7500 V, 1200 amps 2—2500 V, 200 amps
1— 7500 V, 600 amps

*ALSO: Potential transformers, time element overload and current relays, reverse power relays, auxiliary relays, KWH meters, voltmeters, wattmeters and ammeters.*

**HUGO NEU CORPORATION**
**31 Nassau St. New York 5, N. Y.**

---

## BOILERS—COMPRESSORS

1—65,000 lbs. per hr. 450 lbs. pressure sectional steel header, 4" straight tube type boiler.

3—600; 2—565; 2—400 HP B&W vertical forged steel sectional header, 200 lbs. pressure water tube boilers.

2—200 HP Package Boilers.

1—850; 1—1500 cubic ft. motor driven air compressors, 110 lbs.

A full stock of power and distribution transformers, switch gear, including potential and current transformers, circuit breakers etc. at reasonable prices.

*We buy entire central station and power stations.*

*We do our own rigging and dismantling.*

**HOWE BROTHERS**
**342 MADISON AVENUE Murray Hill 2-8562 NEW YORK 17, N. Y.**

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# TRANSFORMERS

FOR SALE

2— 150 KVA. 60 CY. 1 PH. 2400-240/ SCOTT TAPS.
6— 100 KVA. 60 CY. 1 PH. 2400-240/120.
6— 75 KVA. 60 CY. 1 PH. 2400-240/120
9— 50 KVA. 60 CY. 1 PH. 2400-240/120.
7—37½ KVA. 60 CY. 1 PH. 2400-240/120.
8— 15 KVA. 60 CY. 1 PH. 2400-480/240

ALSO ALL TYPES OF AIR COOLED AND PHASE CHANGERS.

**ATLANTIC TRANSFORMER CO.**
**5143 N. 2nd St. Philadelphia 20, Pa.**

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**BOILERS—TURBINES—ENGINES—DIESELS**

Boilers 50-200 HP; Turbo Gen. 100-6000 KW St. Eng. Gen. 75-1000 HP — *Write for our Free New List of High Grade Used Equipment.*

**BENJAMIN W. BISSELL, Reg. Engineer**
**521 K of P Building, Indianapolis 4, Ind.**
**Phone: Lincoln 4007**

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**VERT. HYDRO ELEC. UNITS**

5 units from 120-400KW exc. on top. Leffel wheels Wd.Wd. governors 2400 volts.
3 horiz. Pelton units 5000KVA for 425' head.
1 horiz. 240 KW for 250' head.
1 144 KW vert. 480 volts for 10-12' head.
2—15" Leffel scroll wheels 150-250' head.
1 400 KW horizontal alternator 2300 volts 180 RPM.
Many others. All subject to prior sale.

**WM. C. MOULTON ASSOC., MONSON, MASS.**

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## FOR SALE

Power plant equipment. Steam, Diesel, electrical, boilers, engines, turbines, generators, new or used.

**PENN MACHINERY COMPANY**
**Jackson, Miss.**

### SLIP RING MOTORS 3-Ph., 60 Cy.

| HP | Volts | Make | Speed |
|---|---|---|---|
| 500 | 2300 | G.E. | 450 |
| 450 | 440/220 | Whse. | 514 |
| 400 | 2300 | G.E. | 1200 |
| 350 | 2300/440 | G.E. | 450 |
| 300 | 440 | Whse. | 3600 |
| 250 | 440/220 | Whse. | 600 |
| 250 | 2300/550 | G.E. | 450 |
| 250 | 550/440 | G.E. | 1200 |
| 200 | 440 | G.E. | 450 |
| 200 | 440 | G.E. | 450 |
| 188 | 4000/2300 | G.E. | 1800 |
| 150 | 440/220 | Whse. | 600 |
| 150 | 440/220 | Whse. (2) | 1800 |
| 145 | 4000/2300 | G.E. | 1800 |
| 125 | 550/440 | G.E. | 1200 |
| 100 | 440/220 | G.E. | 900 |
| 100 (2) | 440/220 | Whse. | 900 |

### SYNCHRONOUS MOTORS 3-Ph., 60 Cy.

| HP | Volts | Make | Type | RPM |
|---|---|---|---|---|
| 600 | 440/220 | G.E. | ATI | 600 |
| 300 | 2200/440 | G.E. | TS | 720 |
| 300 | 440/220 | G.E. | ATI | 600 |
| 250 | 440/220 | Whse. | HR | 277 |
| 250 | 440/220 | G.E. | ATI | 600 |
| 250 | 4000/2300 | El. Mchy. | Syn. | 600 |
| 240 | 2300/440 | G.E. | ATI | 720 |
| 200 | 4150/2300 | Whse. | G | 1800 |
| 120 | 440/220 | G.E. | ATI | 900 |
| 110 | 440/220 | G.E. | TS | 257 |
| 100 | 440/220 | Whse. | G | 1800 |
| 75 | 2300/440 | Whse. | GE | 600 |

### PLATING UNIT

1—5,000 amp., 4/6 volt (or 2,500 amps., 8/12 volts) A.P. Munning, double commutator, dir. conn. to 50 hp, G.E. sq. cage motor.

### CIRCUIT BREAKERS

2—2000 amp., GG E. 3 pole, 600 v., air
2—1600 amp., ITE. 3 pole, 600 v., air
2—1200 ampers, Whse., 3 pole, 600 v., air
1—400 amp., 37000 V., G.E., Type FHKO-238 outdoor type, high interruptieg capacity.

### SQUIRREL CAGE MOTORS

| HP | Volts | Make | Type | Speed |
|---|---|---|---|---|
| 650 | 440 | G.E. | FT | 3600 |
| 500 | 2300/4000 | Elliot | SC | 1800 |
| 350 | 2300 | G.E. | KT | 1200 |
| 300 | 2300 | G.E. | FT | 3600 |
| 250 | 440 | G.E. | IK | 720 |
| 200 | 440 | G.E. | IK | 514 |
| 200 | 440/220 | Whse. | CS | 1200 |
| 200 | 440/220 | G.E. | KT | 1800 |
| 200 | 2300/440 | G.E. | KF | 720 |
| 200 | 2300/550 | Cr. Wh. | SC | 900 |
| 200 | 2300/440 | G.E. | KT | 1200 |
| 200 | 440/220 | G.E. | IK | 450 |
| 150 | 440/220 | Whse. | CS | 900 |
| 150 | 440/220 | G.E. | IK | 450 |
| 100 | 2300/550 | Whse. | CS | 900 |
| 150 | 440/220 | G.E. | KT | 720 |
| 150 | 440/220 | Howell | B. Brg. | 1800 |
| 150 vert. | 440/220 | G.E. | KTF | 1200 |
| 150 | 440/220 | G.E. | IK | 514 |
| 150 | 2300/440 | G.E. | KT | 600 |
| 100 | 2200/440 | G.E. | K | 1200 |
| 75 (5) | 550 | G.E. | KF | 1800 |

### A. C. GENERATORS

1—320 kva, 600 rpm, 2300/440/220 V., G.E.
1—250 kva, 720 rpm, 2300/440 v., G.E.
1—225 kva, 600 rpm, 220/440 v., G.E.
1—225 kva, 720 rpm, 2300/440 v., G.E.
1—150 kva, 900 rpm, 480/240 v., G.E.
3— 75 kva, 1800 rpm, 480/240 v., Whse.
1— 50 kva, 1200 rpm, 440/220 v., G.E.

### D. C. MOTORS

| HP | Volts | Make | Type | Speed |
|---|---|---|---|---|
| 350 | 230 (2) | G.E. | CD | 1150 |
| 250 | 230 (2 new) | Cr. Wh. | CMC | 1900 |
| 150 | 230 (2) | Whse. | SK | 850 |
| 150 | 230 | Cr. Wh. | TEFC | 900 |
| 100 | 230 | Cr. Wh. | CMC | 825 |
| 100 | 230 | G.E. | CD | 1750 |
| 75 | 230 | G.E. | CD | 1150 |
| 75 | 230 | Whse. | SK | 850 |

### MOTOR GENERATOR SETS

1—100 kw, 1200 rpm, 240/120 V., Al. Chal., conn. to 150 hp, 440 V., sq. cage.
1—100 kw, 250 v., Hertner, 1200 rpm, connected to 150 hp, 220/440 v., synchronous
1—75/90 kw, 250 V., 1200 rpm, G.E. conn. to 135 hp, 440/220 V., sq. cage
1—75 kw, 125 v., 1200 rpm, G.E. conn. to 120 hp, 2200/440 v., syn. motor.
1—65 kw, 1200 rpm, 250 V., G.E., conn. to 100 hp, 1200 rpm, 440 V., synchronous
1—50 kw, 250/125 V., 1200 rpm, 3-wire, G.E., conn. to 75 hp, 440/220 V., sq. cage

### TRANSFORMERS 60 CY.

2—333 kva, G.E., 13,200—2300 V.
2—333 kva, G.E., 4600/2300—220/460 V.
3—300 kva, Whse., 13200—440 V.
3—250 kva, Whse., 11,000/22,000—2300 V.
3—250 kva, Whse., 2200—208 V.
3—200 kva, Whse., 13,200—2300 V. (Insrtaen)
4—200 kva, Moloney, 2400—220/460 V.
3—150 kva, Whse., 2400—240/480 V.
3— 75 kva, Moloney, 4150—240 V.
3— 75 kva, G.E., 2400—240/480 V.
6—150 kva, Al. Chal. 2400—240/120 v.
1—150 kva, Whse, SK, 13200-125/215 v., 3 ph.
2— 75 kva, G.E., 480—240/120 v., Pyranol
3— 50 kva, G.E., 480—240/120 V., Pyranol

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HARRY J. RICE PRES.

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250 KW, 300 KW A.C. and D.C.

2000 KW 3 phase, 50 cycles, 6300 volts

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| 6 GE FK132B 400 A., 15 KV | 1 GE FK46 600 A., 7.5 KV |
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| | |
|---|---|
| 1 GE FHKO-236-2452 BF73 | 73 KV 400 A. 500 MVA |
| 1 GE FHKO-139-42 BF 73-A | 73 KV 600 A. 1,000 MVA |
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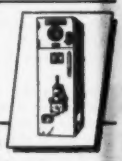

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| 3 | 1250 | GE | H—VDDJ | 13800 | 575/600 |
| 2 | 750 | GE (3 PH) | HT—DH | 4150Y | 208Y/416 |
| 3 | 333 | PITTS. | ODSC | 33000 | 2300 |
| 1 | 250 | GE (3 PH) | HT—R | 460 | 216Y/125 |
| 3 | 200 | GE | H—KDD | 2400 | 120/240 |
| 6 | 200 | PITTS. | ODSC | 2300 | 575 |
| 2 | 200 | WEST. | S | 2400/4160 | 600 |
| 3 | 200 | MOLONEY | | 600 | 220/110 |
| 1 | 150 | GE | H—KF | 2400/4160Y | 240/480 |
| 1 | 150 | PITTS. | ODSC | 13200 | 2300 |
| 4 | 100 | PITTS. | | 2100 | 110/220 |
| 2 | 100 | WAGNER | HE | 3980 | 115/230 |
| 3 | 75 | GE | H—K | 2200 | 244/488 |
| 2 | 50 | WEST. | SK | 22000 | 2300 |
| 3 | 50 | GE | H | 440 | 220/110 |

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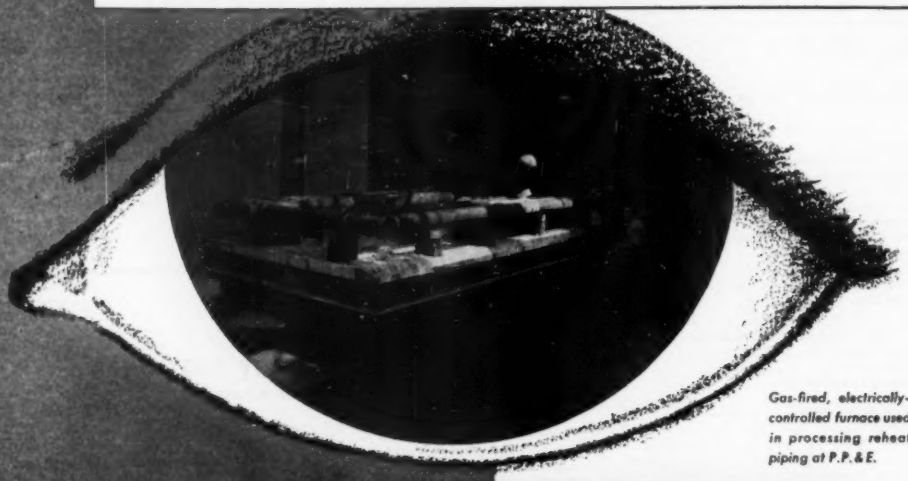
# Looking at REHEAT



*Gas-fired, electrically-controlled furnace used in processing reheat piping at P.P.&E.*

## Through Experienced Eyes

Proper piping is essential in order to realize the benefits inherent in reheating steam to higher temperatures—increased volume per pound of water evaporated . . . reduced condensation in lines, casings, cylinders, etc. . . . improved BTU output . . . better fuel economy.

Remember when 750° F. was thought to be a high reheat temperature? Even then P.P.&E. was ahead of the needs in piping that would carry the load. As the trend toward higher temperatures continued, P.P.&E.'s experience accumulated.

That's why the conditions encountered in present-day reheat temperatures over 1000° F. are thoroughly understood by P. P. & E. engineers—and why adequate materials, design know-how, methods of treating and fabricating, and testing procedures are available.

Look to Pittsburgh Piping and Equipment Company for the experience, and the leadership in methods that assure greatest safety, highest efficiency, and longest service from high temperature, high pressure piping.

**P. P. & E. Products**

| | |
|---|---|
| **Carbon Steel Piping** | **Forged Piping Materials** |
| **Cast Iron Fittings** | **Headers** |
| **Cast Steel Fittings** | **Manifolds** |
| **Chrome-Moly Piping** | **Pipe Bends** |
| **Copper Piping** | **Stainless Steel Piping** |
| **Corrugated Piping** | **Van Stoning** |
| **Creased Bends** | **Valves** |
| **Expansion Bends** | **Welding Fittings** |
| **Flanges** | **Welded Assemblies** |

**Pittsburgh Piping**
**AND EQUIPMENT COMPANY**
*10 Forty-Third Street—Pittsburgh, Penna.*

Woolworth Building, New York
Whitehead Building, Atlanta
Book Tower, Detroit
525 Market Street, San Francisco
Peoples Gas Building, Chicago
Public Square Building, Cleveland
10 High Street, Boston
Henry's State Bank Bldg., Houston

## HOW IT WORKS

Supersonic waves are sent into the material under test. Upon reaching the other side, or upon reflection by a discontinuity, the waves return to their source and are then converted into a high-frequency potential. This potential is amplified by electronic circuits and projected upon the screen of a cathode-ray tube where they may be seen and examined.

Pulse pattern, showing the initial pattern at the extreme left and the reflection from the opposite side at the extreme right. The sweep line indicates no defects.

A typical indication of a defect is illustrated here. By means of calibration, it is now possible to determine both the exact position of the flaw, as well as its size.

Today, Supersonic testing is available on specification for inspecting Grinnell prefabricated piping. By observing the pattern produced by the electron beam on the fluorescent screen, any defects in the base metal, welds, or variations in pipe thickness can be located and measured at a glance.

Grinnell's ultra modern electronic testing can be relied upon to detect hidden flaws in pipe materials, to check unerringly the quality of welds where it picks up types of flaws not revealed by X-ray and gamma ray inspection. In examining bends, this type of testing can measure the degree to which bent pipe thins on the outside and thickens on the inside of the bend, assuring full specified thickness in high temperature, high pressure work.

Non-destructive Supersonic testing is another in a constant succession of new techniques employed by Grinnell to provide prefabricated piping which is safe and dependable . . . which measures up in every way to *rigid* state, national, association and insurance code requirements. It is another reason, too, why it will pay you to think of Grinnell "Whenever Piping Is Involved".

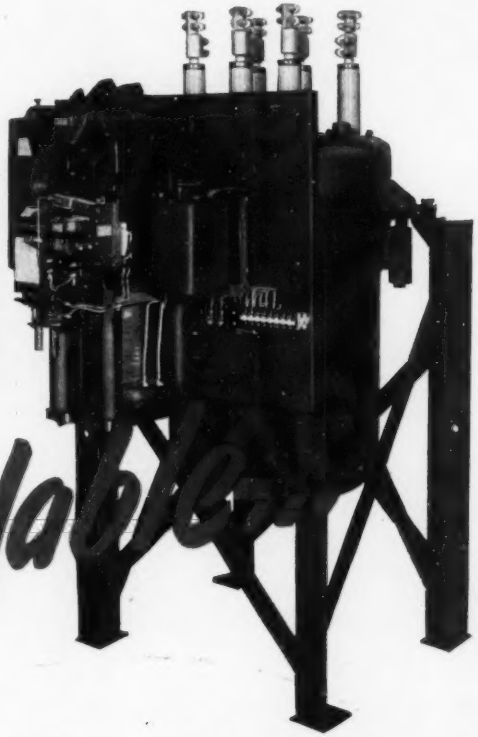
# GRINNELL

**WHENEVER PIPING IS INVOLVED**

GRINNELL COMPANY, INC., Providence, R. I. Warehouses: Atlanta • Billings • Buffalo • Charlotte • Chicago Cleveland • Cranston • Fresno • Kansas City • Houston • Long Beach • Los Angeles • Milwaukee • Minneapolis • New York Oakland • Philadelphia • Pocatello • Sacramento • St. Louis • St. Paul • San Francisco • Seattle • Spokane

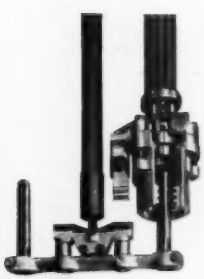
**ALLIS-CHALMERS**

INDUSTRIAL
Oil Circuit Breakers



# Dependable

# Electrical Protection for Industry



YOU CAN GET full electrical protection for equipment in your plant with the 8-cycle DZ oil circuit breaker. It is liberally and compactly designed to meet your requirements economically.

Mechanically and electrically trip-free, it combines reliability in operation with the advantages of the single break *Ruptor* interrupting device.

The DZ comes in a wide range of ratings. Mounting with framework or for cubicle, solenoid or manual closing, standard operating voltages, all in accordance with ASA standards.

For more information, see your nearby A-C sales office. Or write Allis-Chalmers, Milwaukee 1, Wis. for bulletins 71B6129D (DZ-60B, DZ-100B, DZ-200B) and 71B6179C. (DZ-40B) A-3381

*Ruptor* is an Allis-Chalmers trademark.

| TYPE | RATED K.V. | MINIMUM KV AT RATED KVA | RATED AMPS. | KVA INT. CAPACITY |
|---|---|---|---|---|
| DZ-40B | 7.2 | 2.3 | 600 | 100,000 |
| | | | 1200 | 100,000 |
| | | | 2000 | 100,000 |
| DZ-60B | 13.8 | 4.0 | 600 | 150,000 |
| | | | 1200 | 150,000 |
| DZ-100B | 13.8 | 4.0 | 1200 | 250,000 |
| DZ-200B | 13.8 | 6.6 | 1200 | 500,000 |
| | | | 2000 | 500,000 |

The circuit interrupting efficiency of the *Ruptor* arc interrupting device is the result of simple, yet highly effective contact structure. Its effectiveness is proved over many years of service in these and larger power oil circuit breakers.

**ALLIS-CHALMERS**